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THE CETACEA.

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THE Cetacea, as the inhabitants of the water areas of the earth's surface, have had ample space for variation and multiplication of forms, an opportunity of which only a moderate advantage has been taken. The conditions have been more uniform than those to which land mammals have been subject, and a corresponding uniformity prevails in this order. Owing to their habitat, opportunities for their preservation have been better than in the case of animals of the land, and accordingly great deposits of their bones exist, notably on the east coast of the United States, and in certain deposits of Belgium and Italy. Among the species brought to light in these localities, as among those now existing, we find examples of the most gigantic, not only of the Mammalia, but of the Vertebrata. The exising *Balænoptera borealis* reaches a length of over one hundred feet; and several other species, including the sperm whale, attain to eighty feet.

The order of Cetacea is one of those of whose origin we have no definite knowledge. It appears sparingly in the Zeuglodontidæ in the Eocene period, and has its greatest multiplication in the ages of the Miocene. The Zeuglodontidæ are the most generalized family, and forms intermediate between them and the modern Cetacea are found in Miocene beds. Modern types are, however, contemporaries of the latter, and these have achieved a multiplication of forms in Pliocene and modern times.

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The line of successional modification of the Cetacea is found in changes in (1) the shape of the skull; (2) the extinction of the dentition; (3) the shortening of the cervical vertebræ; and (4) in the separation of the ribs from articulation with the vertebral centra. The modification of the shape of the skull is related to the gradual transfer of the external nostrils to more and more posterior positions, until they remain, in the extreme types, above, or even behind above, the eyes. In this process the nasal, frontal and parietal bones become excessively abbreviated, so that in the modern toothed whales, they form a narrow band between the nostrils and the superior border of the occipital bone.

The order is naturally divided into three sub-orders, which are defined as follows:

External nostrils on the superior side of the muzzle; teeth present; ribs with two heads; *Archæoceti.*

External nostrils above gullet; teeth generally present; no whalebone; some of the ribs with two heads; *Odontoceti.*

External nostrils above gullet; teeth wanting; the gums supporting "whalebone"; ribs articulating by tubercle only; *Mysticeti.*

All of the above characters are those of divergence from the principal mammalian stem, and have relation to the conditions of aquatic life. Thus the posterior position of the nostrils permits inspiration without the elevation of the muzzle above the water-level, which is rendered difficult, if not impossible in the most specialized types, by reason of the extreme flatness and inflexibility of the cervical vertebræ. The absence of teeth is appropriate to the habits of the types which lack them. Thus the Physeteridæ among Odontoceti feed principally on squids, whose soft bodies are swallowed whole. The Mysticeti feed on minute Crustacea and Mollusca, which they retain in the mouth by straining the water through their bristly whalebone, or baleen. The disarticulation and disappearance of the heads of the ribs in the Mysticeti, is appropriate to the support which all the viscera derive from the fluid medium in which these large animals live. Strong articulation of the head of the ribs to the vertebral column is no longer necessary.

Paleontology confirms the inference derivable from their anatomy, that the phylogeny of the Cetacea has followed the order, Archæoceti, Odontoceti, Mysticeti.

The mechanical causes which may have given origin to the modifications which measure this succession, may be suggested as follows: The shortening and obliteration of the neck is probably due to disuse, since the general mobility of the body in a watery medium renders much flexibility of the neck unnecessary, the entire body being readily turned about. It may have resulted, also, from the increase in the relative proportions of the head, which renders it extremely difficult to handle; a function which is, in the modern Cetacea, quite aborted. The early and rapid reduction, and in some lines, extinction of the dentition, is a result of disuse consequent on the increasing percentage of soft or minute food used by the more modern types. So the loss of the rib-heads in the Mysticeti may be traced to disuse, since, as above remarked, they lack the strain caused by the weight of the thoracic and abdominal walls and the contained viscera, which they experience in animals which are not supported by some external medium. The same reduction took place in the ocean-dwelling Plesiosauria,[1] and in those terrestrial reptiles in which the weight of the body is borne on the earth, as the lizards proper, and snakes. As regards the gradual transfer posteriorly of the external nostrils, the following mechanical hypothesis has been suggested. They have been used as a discharge pipe for air and water from the lungs and mouth, and, of course, facility of exit is directly as the shortness of the conduit. It is possible that the constantly recurrent presence of a column of air and water on the posterior inferior wall of the nareal canal has literally pressed back this obstructive roof, until it has ceased to resist the outflow by becoming vertical.

I. ARCHÆOCETI.

This suborder embraces but one known family, which is defined as follows:

Frontal bones with flat, expanded supraorbital region; teeth two-rooted posteriorly, one-rooted anteriorly; *Zeuglodontidæ.*

[1] It must be remarked here that the equally marine Ichthyopterygia have two-headed ribs, but they are of equal length, close together, and mechanically equivalent to one.

The species of this family belong to the genus Zeuglodon[2] Owen, although when the *Z. brachyspondylus* Müll. is better known it may be found to be referable to a distinct genus, Doryodon Gibbes. The longer known *Z. cetoides* Ow. is distinguished by many peculiarities. Its skull presents a long symphysis of both premaxillary and mandibular bones. The cervical and dorsal vertebræ are of similar and medium length, while those of the lumbar region are remarkably elongate. The fore-limb was short, and in its cubital region quite narrow (teste Müller). The enamel of the teeth is wrinkled, and the posterior two-rooted teeth have coarsely serrate cutting edges fore and aft. The animal could not have been less than seventy feet in length. Bones of species of Zeuglodon have been found in the Upper Eocene of Arkansas and the Gulf States (in the White Limestone of Alabama), and of England and Egypt. It is also recorded as occurring in the Miocene of Malta.

II. ODONTOCETI.

This group is the most numerously represented by species, recent and extinct. The families differ as follows:

I. Teeth of two types, one and two-rooted.

Neck longer; teeth in both jaws; *Squalodontidæ.*

II. Teeth uniformly one-rooted,

a, Ribs nearly all two-headed.

Teeth in both jaws; neck generally longer; *Platanistidæ.*

Teeth in lower jaw only; neck short; *Physeteridæ.*

aa, Four or five anterior ribs only two-headed.

Teeth in both jaws; neck short; *Delphinidæ.*

The SQUALODONTIDÆ resemble the Zeuglodons in the form and character of their teeth, but the form of the skull is very different. They nevertheless, by their intermediate position, indicate the ancestral relation of the Zeuglodontidæ to the other Cetacea. But little is known of the skeleton of the Squalodontidæ. The species occur in Miocene beds of North America and Europe. They did not attain such huge proportions as the Zeuglodons, and did not exceed thirty feet at the most. The genera known are two, as follows:

[2] *Basilosaurus* Harl.

The posterior molars two-rooted; *Squalodon* Gratel.
Some of the posterior superior molars three-rooted; *Trirhizodon* Cope.

Squalodon grateloupii Pedroni and *S. antverpiensis* Van Ben. are the most abundant European species. In America the *S. atlanticus* Leidy has been found in New Jersey and Maryland, and the *S. holmesii* Leidy, a species with more delicate teeth than the last, has been discovered in South Carolina.

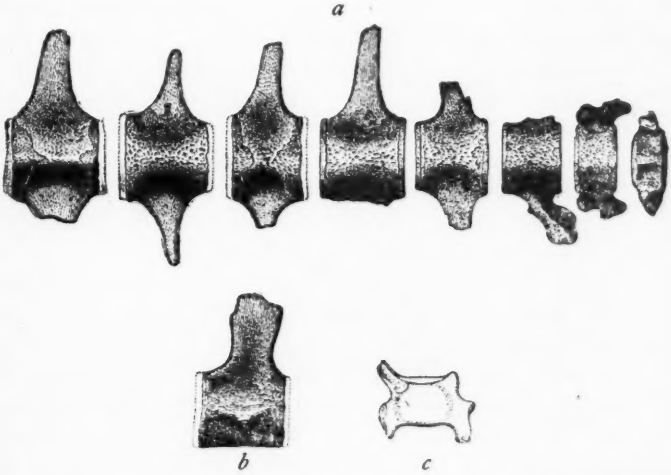


FIG. 1.—*Ixacanthus spinosus* Cope dorsal and lumbar vertebræ, two-sevenths natural size; *a*, from below; *b*, lumbar from side; *c*, cervical from front. Type; original; from Miocene of Maryland.

The greater number of the PLATANISTIDÆ are extinct. The genera differ much among themselves in the number and form of the teeth, and the relative form of the neck. Some of the species reach the size of the smaller whales, as the *Cetophis heteroclitus* Cope; but most of the species have the average dimensions of the dolphins. The genera differ as follows:

I. Teeth with roots extended transversely.
Teeth with lateral basal lobes; lumbar diapophyses wide; *Inia* Geoffr.

II. Teeth with cylindric roots.

α, Caudal vertebræ plano-convex.

No caudal diapophyses; *Cetophis* Cope.

αα, Caudal vertebræ plane.

β, Lumbar diapophyses spiniform.

Lumbar and caudal vertebræ slender; *Zarhachis* Cope.

Lumbar and caudal vertebræ short; *Ixacanthus* Cope.

ββ, Lumbar diapophyses wide, flat.

Muzzle elongate, slender; cervical vertebræ long; *Priscodelphinus* Leidy.

Muzzle slender; cervical vertebræ shorter; *Pontoporia* Gr.

III. Teeth with longitudinally flattened roots.

Teeth in entire length of maxillary bone; symphysis connate; *Stenodelphis* Gerv.

Teeth on all the jaws; symphysis not connate; an erect osseous crest on posterior part of maxillary; *Platanista* Cuv.

Teeth at the base of the maxillary only; muzzle produced into a sub-cylindrical beak; *Rhabdosteus* Cope.

IV. No teeth; an alveolar groove.

Muzzle depressed, elongate; *Agabelus* Cope.

The recent species belong to the genera Inia, Pontoporia and Platanista. The two first are found in the rivers of S. America, and the *Platanista gangetica* in the rivers of India. Their posterior ribs are one-headed. The genera with spiniform diapophyses of the posterior vertebræ are only known so far from N. America. The *Ixacanthus cœlospondylus* Cope was a short robust species about the size of a white whale. Another line of modification is seen in the attenuation of the vertebral column. The most remarkable elongation of the vertebræ is found in Zarhachis, a character which is only paralleled in Zeuglodon. Of the other genera, Stenodelphis, with its single species *S. canaliculatus* (Delphinus, von Meyer), has been so far found in the middle Miocene of Central Europe. Priscodelphinus occurs in the Miocene of North America and Europe. The *P. grandaevus* Leidy (Figs. 2 and 3), of the Miocene of New Jersey has a slender muzzle, with a full series of curved cylindric teeth; a neck like that of a seal

in proportions, and a long slender body. The first sternal segment is T-shaped, and the ribs are slender, compressed, and mostly two-headed. The paddles are unknown. Other species of the genus are found in the Miocene beds of Maryland. The species of the remaining five genera have been found thus far only in the Miocene of North America. Nineteen species of Platanistidæ have been described from the latter region.

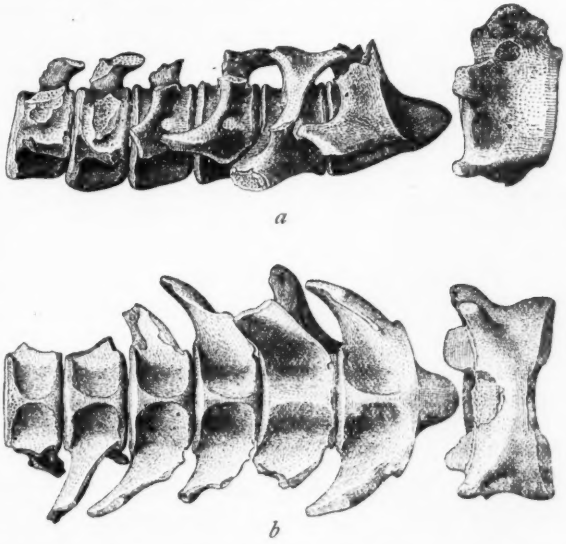


FIG. 2.—*Priscodelphinus grandaevus* Leidy, cervical vertebræ; *a*, from side; *b*, from below. Original; from Miocene of Cumberland County, N. J. One-third natural size.

One line of modification observable in the extinct genera is towards the extreme which is seen in Rhabdosteus Cope. Here the muzzle reaches an extraordinary elongation, and for the greater part of its length forms an edentulous cylinder, which resembles the beak of the sword-fishes. The few teeth which remain at the base of the muzzle are like those of Platanista, with roots compressed so as to be longitudinal, and crowns compressed so as to be transverse, to the axis of the skull. The *R. latiradix* Cope (Fig. 4.), is not uncommon in the Miocene beds of Maryland. Its

skeleton is unknown. The nearest approach to Rhabdosteus is made by the genus Stenodelphis. In Cetophis, the caudal centra have one face very convex, offering greater flexibility than is possible in any other genus. The *C. heteroclitus* is from the Maryland Miocene. A genus Lophocetus has been established for the *Delphinus calvertensis* of Harlan, also from the Maryland Miocene. Its position is uncertain; the skull resembles that of Inia, but the roots of the teeth are cylindric. The temporal and occipital ridges are very strong. Skeleton unknown. Delphinodon Leidy is represented by teeth only, from N. American localities, but a skull is described by Burmeister from Buenos Ayres, which shows that the nostrils are much more anterior in position than in Lophocetus.

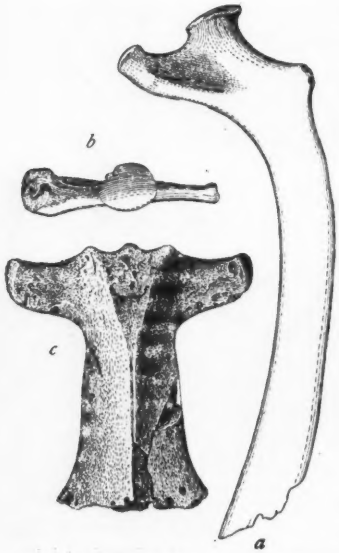


FIG. 3.—*Priscodelphinus grandaevus* Leidy; one-half natural size; Miocene of Cumberland County, N. J. *a*, rib from side; *b*, do. proximal extremity; *c*, mambrium sterni. Individual represented in Fig. 2.

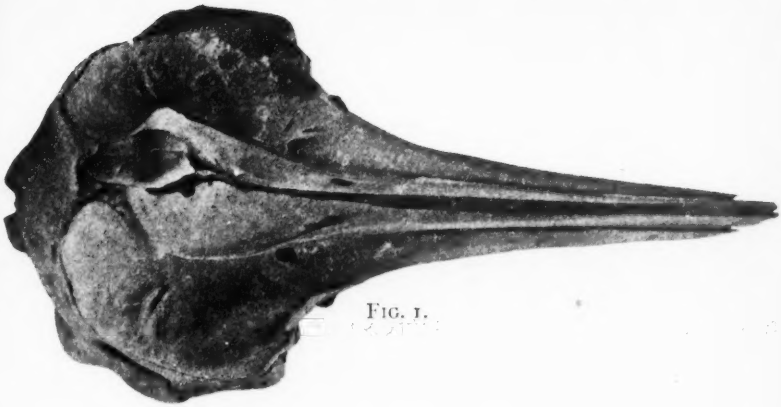
Extinct and recent forms about equally divide the PHYSETERIDÆ, but the largest dimensions are reached by the recent sperm whale, *Physeter macrocephalus* L. The modifications of the family type are chiefly those of the dentition, but the skull develops crests of a peculiar character in a number of the genera. These are distinguished as follows:

I. Lower jaw with numerous teeth.

a, Teeth with crown and root continuous, and without enamel. Inion and temporal ridges forming a crest which encloses a basin-shaped cavity of the front. Zygoma complete; symphysis mandibuli long; *Physeter*[3] Linn.

[3] *Eucetus* DuBus.; *Physetodon* McCoy; *Stenodon* VanBen=*Orycterocetus* Leidy.

PLATE XX.



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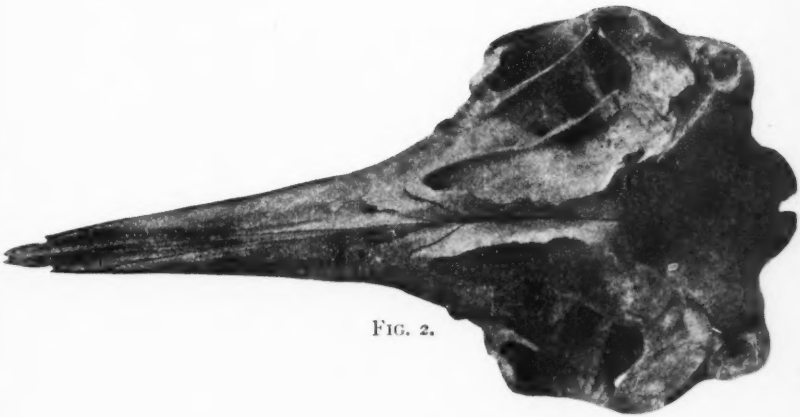

FIG. 2.

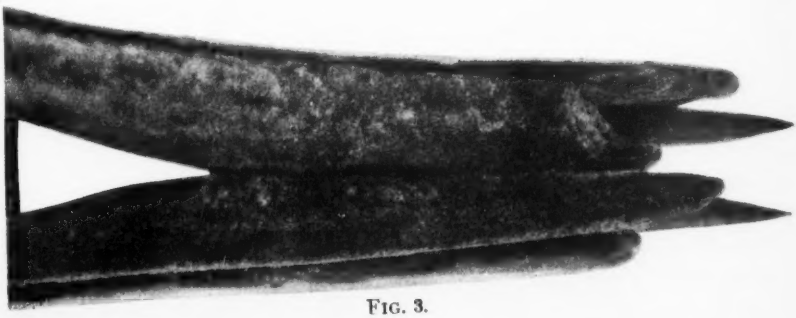

FIG. 3.

Choneziphius semijunctus Cope.

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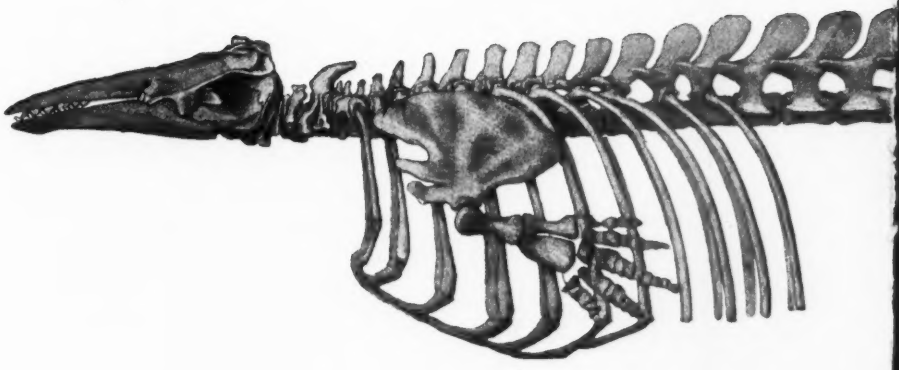
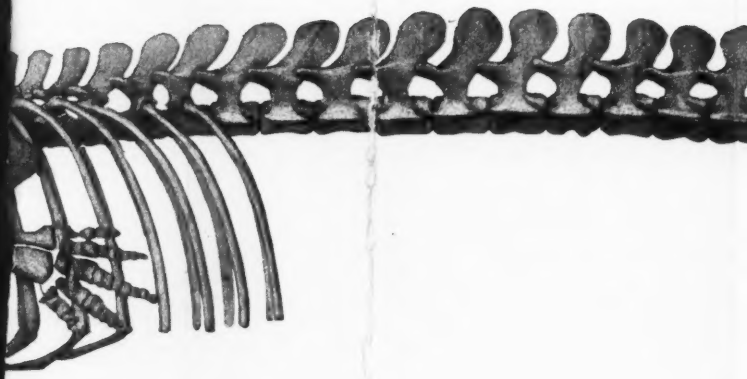
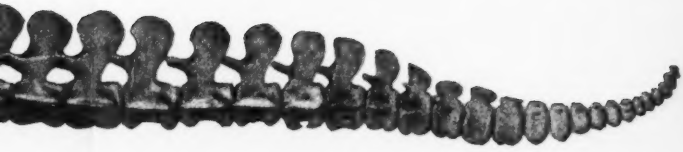


Delphinap

PLATE XXI.



Delphinapterus leucas Pallas.



Zygoma interrupted; symphysis short; *Kogia*[4] Gray.

aa, Teeth fusiform, with enameled crown.

Cement coating thick; *Physodon*[5] Gerv.

aaa, Crown and root of teeth distinct; crown with enamel.

Cement very thick; *Hoplocetus* Gerv.

II. Low jaw with very few teeth.

a, Maxillary bones with vertical longitudinal crest behind.

A tooth at the extremity of each ramus mandibuli; *Anarnacus*[6] Lacep.

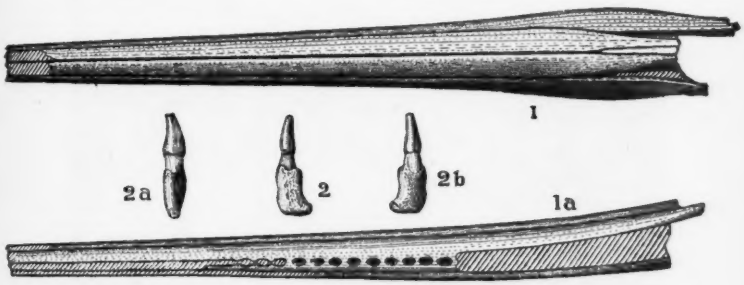


FIG. 4.—*Rhabdosteus latiradix* Cope (type); two-ninths natural size; original; from Miocene of Maryland. 1, muzzle from above; 1*a*, do. left side; 2, 2*b*, tooth from side; 2*a*. do. from edge. The posterior parts of the maxillary and premaxillary bones are restored from a different specimen from that represented in the rest of the figures. Teeth also separate; two-thirds natural size.

aa, Maxillary without vertical posterior crests.

Two teeth at the extremity of each mandibular ramus; *Berardius* Less.

Mandibular ramus with a terminal tooth; *Choneziphius* Duv.

Mandibular ramus with a median tooth; *Mesoplodon* Gerv.

As already remarked, the extinct sperm whales do not equal in dimensions the single recent species. Their teeth differ a good deal from those of the latter. Thus the American form, which Leidy called Orycterocetus, have the crowns quite slender, and the pulp-cavity large. They occur in the Miocene beds from

[4] *Physeterula* Van Ben.

[5] *Scaldicetus* DuBus [?]; *Balænodon* Owen.

[6] *Hyperoödon* Lacep.

Maryland to North Carolina. The species from the Miocenes of Belgium and Australia have the pulp-cavity very small. The Kogias or pigmy sperm whales are found in all southern and tropical seas. A single extinct species, the *K. dubusii* Van Ben. has been found in the Miocene beds of Belgium. *Hoplocetus carolinensis* Leidy is from the phosphatic deposits of South Carolina. But one extinct species of Anarnacus (Hyperoödon) (Fig. 5), has

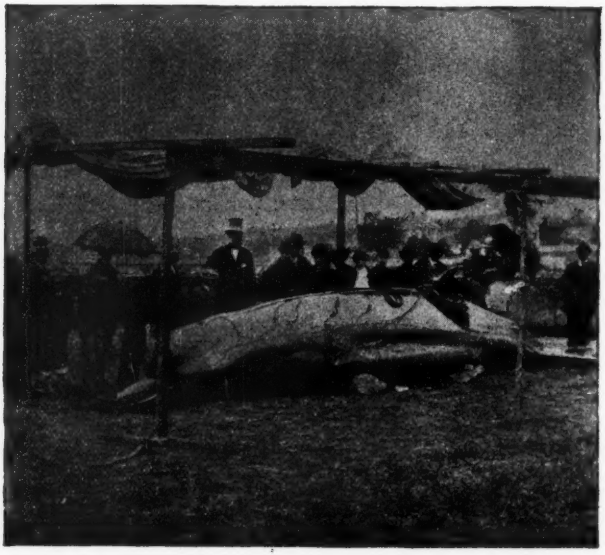


FIG. 5.—*Anarnacus rostratus* Wesm, from a photograph taken at Newport, R. I.

been yet found (in Belgium), but species of Choneziphius are abundant in the Miocene beds of both Europe and North America, Five species have been described by Leidy from the South Carolina phosphatic beds, of which the most conspicuous is the *C. trachops*. Mesoplodon is represented in the same formations by one species, the *M. prorops* Leidy. A species of each genus still lives on the coast of the United States, the *Choneziphius semijunctus* Cope (Plate XX.), and the *Mesoplodon bidens* Sowerby.

The DELPHINIDÆ are preëminently a modern type (Fig. 6). They display a tendency to the reduction of the rib heads, which is completed in the whale-bone whales, and the nostrils are far posterior, and the nasal bones mere tuberosities. The dentition differs within moderate limits; the killers, as the carnivora of the sea, having it powerfully developed, while in the grampus and Globiocephalus many of the teeth are shed. Monodon develops a large incisor with which it breaks the ice in Arctic regions. The genera differ as follows:

I. Cervical vertebræ mostly distinct.

a, Incisors not differentiated.

Teeth few, caducous; *Delphinapterus*[7] Lac.

aa, Superior incisors of one side forming a straight tusk.

Teeth few, deciduous; *Monodon* Linn.

II. Cervical vertebræ mostly coössified.

A. Flippers short, with less than twelve phalanges in the second finger.

a, A dorsal fin.

Teeth few, very robust; palate not grooved; *Orca* Gray.

Teeth medium, numerous, acute; palate not grooved; *Lagenorhynchus*[8] Gray.

Teeth medium, numerous, acute; palate grooved; *Delphinus* Linn.

Teeth numerous; premaxillae elevated in front of nares; palate plane; *Sagmatias*[9] Cope.

Teeth few, easily shed; *Grampus* Cuv.

Teeth compressed, spatuliform; *Phocæna* Cuv.

aa, No dorsal fin.

Teeth numerous, not caducous; *Leucorhamphus*[10] Lillj.

Teeth flat, spatuliform; *Neomeris* Gray.

AA. Flippers long, falciform; index with twelve or more phalanges.

A dorsal fin; teeth few, caducous; *Globiocephalus* Gray.

[7] Beluga Gray.

[8] Tursiops and Prodelphinus Gerv.

[9] Dorsal fin unknown.

[10] Delphinapterus Less. nec Lacep.

But few species of this family are known from terranes of earlier than Pliocene age, and they belong to existing genera. Extinct species of Delphinapterus and Orca have been found in the Italian Pliocene, and of Orca and Globiocephalus in England. In North America the *Delphinapterus orcinus* has been described from the Miocene of North Carolina, and the *D. vermont-*

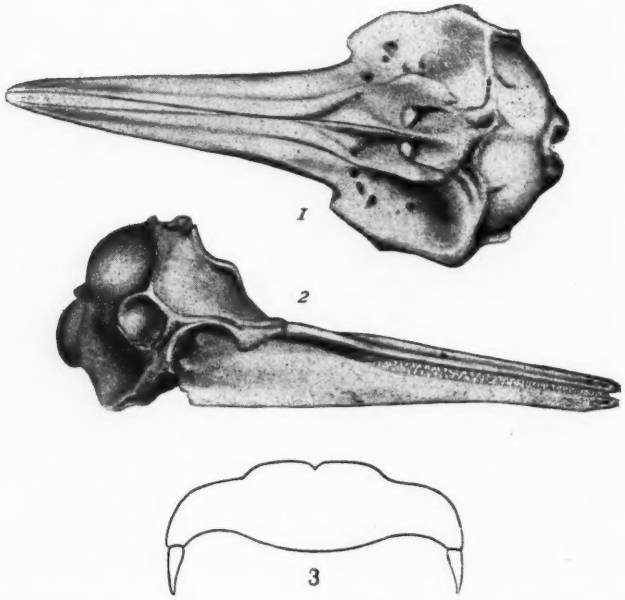


FIG. 6.—*Prodelphinus crotaphiscus* Cope (from type); 1, above, 2, from side; 3, section of muzzle. About one-fifth natural size.

anus has left its remains in the so-called Champlain clays of the drainage basin of the St. Lawrence river, which are perhaps of Plistocene age (Plate XXI.).

MYSTICETE.

This suborder embraces but a single family, the Balænidæ, whose characters may be summarized as follows:

Nareal canal oblique, overroofed by the short horizontal nasal bones, and underroofed by the elongate ptery-

goids; no longtitudinal or transverse crests of the skull; *Balænidæ.*

The family of the whalebone whales is represented by many species both recent and extinct. These fall into a number of natural genera, which display several affinities towards different extremes. Thus the fin-backs (Balænoptera) have developed speed through increased length of body; the humpbacks (Megaptera, have developed especial length of the fore limbs, while the right whales (Balæna) have acquired a huge oral cavity and the greatest length of whalebone. The fin-backs pursue and devour great numbers of fishes of small and medium dimensions, and their maw derives an especial capacity for containing them, through the presence of numerous expansible longitudinal folds of its inferior walls. The Balænæ, on the other hand, take in enormous quantities of water, which contains their minute molluscous food, and so enjoy an especial advantage in this direction,

BALÆNIDÆ are abundant in the Miocene, having an origin prior to that of the Dephinidæ. They would seem to have derived their descent from some form allied to the Squalodontidæ, since their nasal bones are more elongated than those of the Odontoceti, and in Plesiocetus the superior cranial bones show some of the elongation of that family. The genera of Balænidæ differ as follows:

I. Frontal and parietal bones elongated on the median line. Cervical vertebræ distinct; *Plesiocetus* Van Ben.

II. Frontal and parietal bones much abbreviated in the median line.

A, Cervical vertebræ all distinct; fingers four.

a, Numerous gular folds; vertebral canal not enclosed;[11] No coracoid; manus long; *Megaptera* Gray.[12]
A coracoid; manus not elongate; *Cetotherium* Brandt.[13]
Mandible with a long angle; coronoid large; *Herpetocetus* Van B.

[11] The external characters of Cetotherium and Herpetocetus are unknown.

[12] Poescopia Gray, Burtinopsis Van Ben.

[13] Eschrichtius Gray. Cetotheriophanes Brandt.

aa, Numerous gular folds; vertebral canal enclosed by diapophyses and parapophyses;

Both coracoid and acromion; manus short; a coronoid process; a dorsal fin; *Balænoptera*.[14]

aaa, Only two gular folds;

No dorsal fin; an acromion; *Rhachianectes* Cope.

aaaa, External characters unknown; maxillary bones very narrow.

Manus short; *Mesoteras* Cope.

AA. Cervical vertebræ more or less coössified.

Anterior three cervicals only united; *Palæocetus*, Seeley.[15]

All cervicals coössified; fingers five; no gular plicæ; no coronoid process; *Balæna*, Linn.[16]

The genus Plesiocetus is intermediate in its characters, and as it is generalized in structure, it is probably the ancestral type from which modern Balænidæ have been, by a process of differentiation, derived. Four species have been described from Belgium. The largest of these, *P. brialmontii* Van Ben., was some sixty feet in length; while the *P. brevifrons* Van B. and *P. affine* Van B. were twenty feet and less in length. Cetotherium is more nearly allied to Balænoptera (the finners). The number of species appears to have been considerable, several having been described from Southeastern Europe, one from Italy (*C. capellinii*), and others from Belgium and England. Corresponding species have been found in the Miocene beds of the Eastern States of North America. The *C. cephalus* Cope is about thirty feet in in length, the head being nine feet; and its flippers short. The ear bulla is noticeably compressed, somewhat incurved, and with a nearly parallelogrammic outline from the side; (Fig. 7). The skeleton was found in Charles Co., Maryland. (Plate XXII.) There have been described several species, probably of this genus, from the same region and horizon, of smaller size, the least, *C. pusillum* Cope, having been about fifteen feet in length.

[14] Physalus Gray.

[15] Eubalæna, Macleayius, and Halibalæna Gray; Balænula and Balænotus Van Ben.

[16] The difference between Neobalæna Gray and this genus is not yet known.

Species of Balænoptera and Megaptera occur in the European and probably in the American Miocenes. Those of Belgium correspond in various respects with the existing species. Thus *Balænoptera goropii* is compared by Van Beneden with the common existing finner, *B. musculus;* the *B. borealina* Van B. with the *B. borealis* of the Atlantic; and the *B. emarginata* Owen with the small pike whale, *B. rostrata.* Three species of Belgium and England are referred to the hump-backs, or Megaptera. A remarkable genus is Herpetocetus Van B., of which a single species of rather small size has been found in Belgium.

FIG. 7.—*Cetotherium cephalus* Cope, otic bulla. One-half natural size; original; from Miocene of Maryland.

Forms more or less nearly related to the right whales occur in Miocene beds on both sides of the Atlantic. Mesoteras Cope has the characters of the finner whales (Balænoptera) with the narrow maxillary bones of the true Balænæ. A large species with a skull of about eighteen feet in length was found by Prof. W. C. Kerr in Eastern North Carolina, and was named by the writer *Mesoteras kerrianus.* It is distinguished by an enormous thickening of the superciliary part of the frontal bone. The periotic bones are peculiar for their very short proportions, and balæni-form bulla. A small balænoid with only partly coössified cervical vertebræ has been found in the boulder clay of England and named *Palæocetus sedgwickii* by Prof. Seeley. The *P. insignis* Van Ben. from Belgium is also a small species. True Balænæ have been found in various parts of Europe.

In Western Europe three species are recorded from the Miocene, and two from later beds. Of the former, *B. affinis* Owen is similar in size and character to the right whale, *B. mysticetus*, and *B. primigenia* Van Ben. to the shorter headed type represented by the *B. cisarctica* of the middle Atlantic (Plate XXIII.). The *B. balænopsis* Van B. is not over twenty feet in length. In the Plistocene beds of Sweden a true Balæna of the *B. cisarctica* type has been discovered, and has been named *B. swedenborgiana.* It is thus evident that many species of whalebone

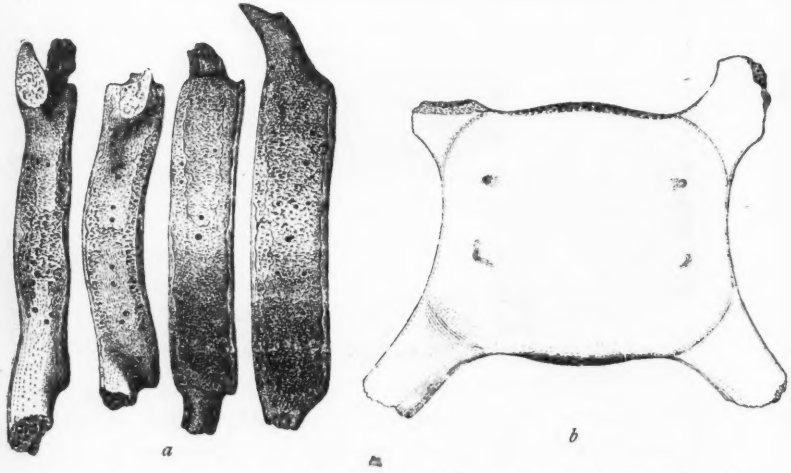


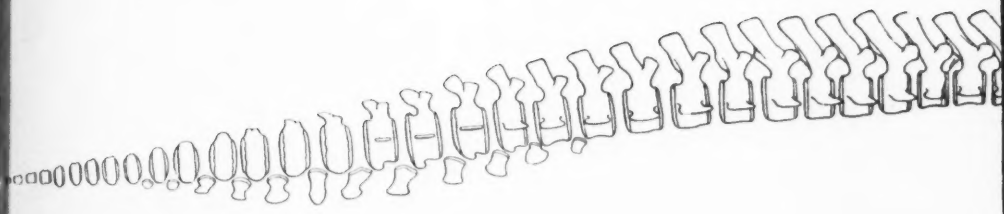
FIG. 8.—*Cetotherium cephalus* Cope, two-fifths natural size; individual represented in Fig. 7. Original; from Miocene of Maryland.

whales have become extinct, some of them in comparatively modern times. Such is the *Cetotherium robustum* Lilljeborg, which is known from a few fragments, not fully fossilized, from an island in the Baltic, and from Cornwall, England.

LIST OF THE EXTINCT CETACEA OF NORTH AMERICA.

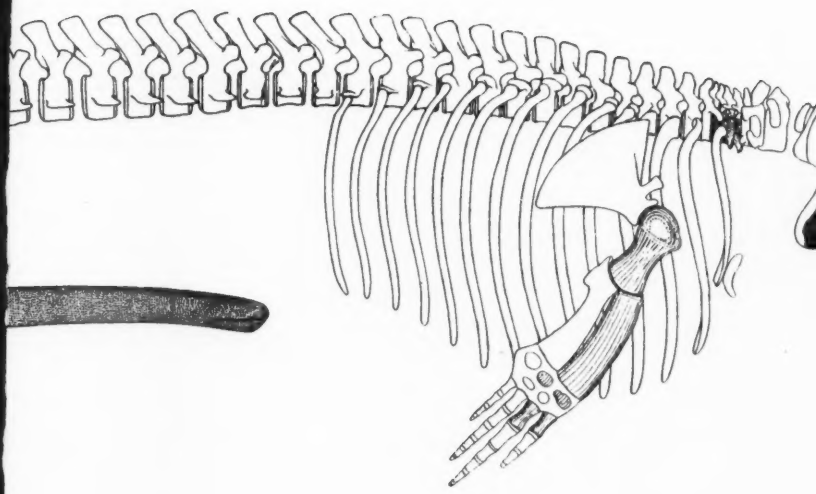
BASILOSAURIDÆ, ... 3

Basilosaurus cetoides Owen. Ala., Miss.
Doryodon serratus Gibbes. Ala., Fla.



a

PLATE XXII.



Cetotherium cephalus Cope.

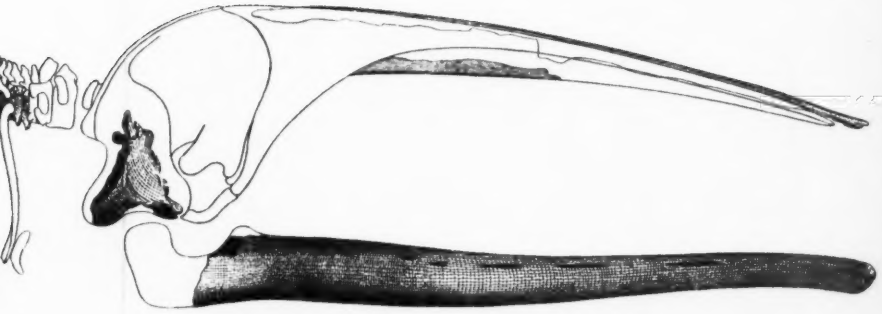


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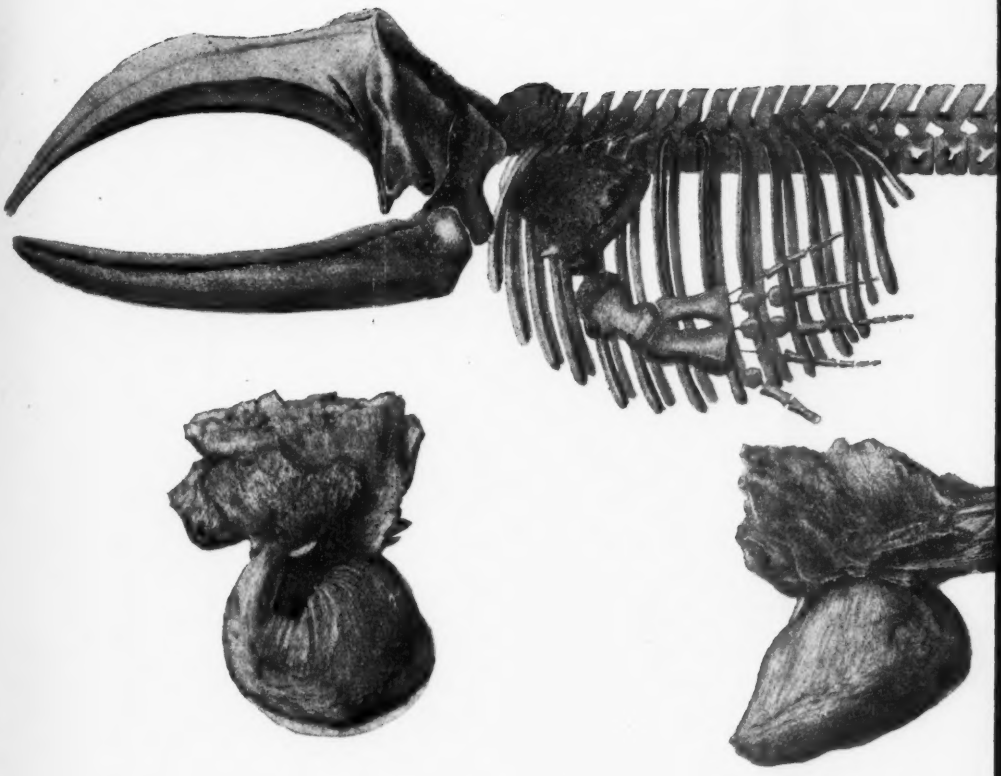
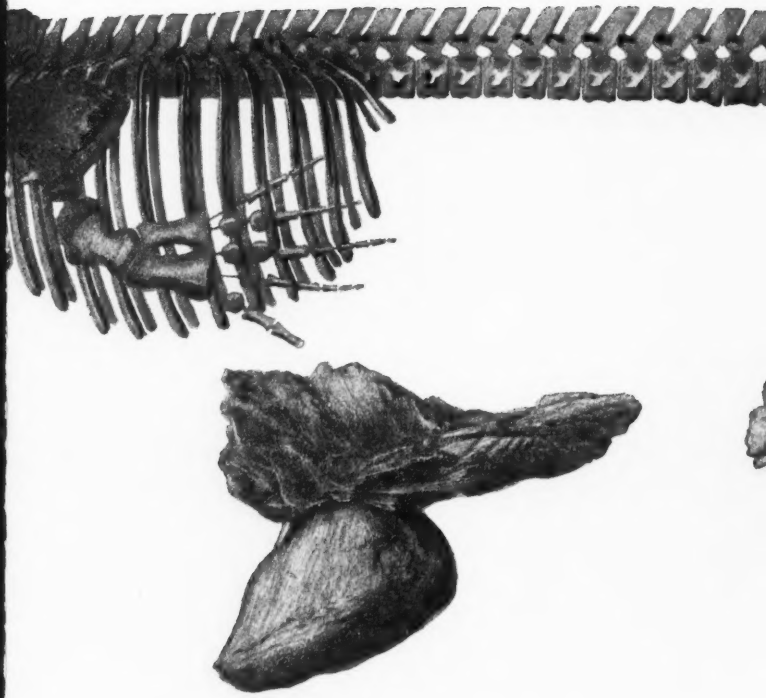
PLATE XX

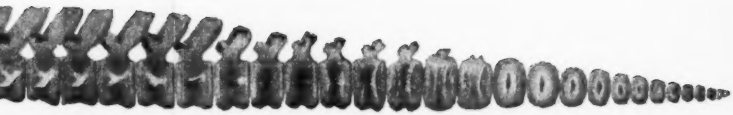


Balæna ci arctica

PLATE XXIII.



Balæna ci arctica Cope.



SQUALODONTIDÆ, ... 6

Squalodon atlanticus Leidy. N. J., Md.
" *vinearius* Leidy. Mass. (Martha's Vineyard.)
" *holmesii* Leidy. S. C.
" *pelagius* Leidy. S. C.
" *pygæmus* Müller. S. C.
" *protervus* Cope. S. C.

PLATANISTIDÆ. 19

Delphinodon mento Cope. S. C.
" *wymanii* Leidy. S. C.
" *venustus* Leidy. S. C.
Lophocetus calvertensis Harlan. Md.
Priscodelphinus grandævus Leidy (=*P. harlani* Leidy). N.J.
" *lacertosus* Cope. Md.
" *gabbii* Cope. Md.
" *uræus* Cope. N. J.
" *ruschenbergerii* Cope. Md.
Zarhachis flagellator Cope. Md.
" *tysonii* Cope. Md.
" *velox* Cope. N. J.
Ixacanthus cœlospondylus Cope. Md.
" *spinosus* Cope. Md.
" *atropius* Cope. Md.
" *conradi* Leidy. Va., Md.
" *stenus* Cope. Md.
Rhabdosteus latiradix Cope. Md.
Agabelus porcatus Cope. N. J.

INCERTÆ SEDIS. 2

Cetophis heteroclitus Cope. Md.
Saurocetus gibbsii Agass. S. C.

PHYSETERIDÆ. 10

Physeter vetus Leidy. N. C.
" *cornutidens* Leidy. N. C., Md.
" *quadratidens* Leidy. N. C.
Hoplocetus obesus Leidy. S. C.
Choneziphius trachops Leidy. S. C.

Choneziphius liops Leidy. S. C.
" *cœlops* Leidy. S. C.
" *macrops* Leidy. S. C.
" *chonops* Leidy. S. C.
Mesoplodon prorops Leidy. S. C.

DELPHINIDÆ. 2

Delphinapterus vermontanus Thompson. Vt., Canada.
" *orcinus* Cope. N. C.
Dephinus occiduus Leidy. Cal.

BALÆNIDÆ, ... 10

Cetotherium pusillum Cope. Md.
" *expansum* Cope. Md.
" *priscum* Leidy. Va.
" *polyporum* Cope. N. C.
" *mysticetoides* Emmons. N. C.
" *cephalus* Cope. Md.
" *leptocentrum* Cope. Va.
Balænoptera palæatlantica Leidy. Va.
" *davidsonii* Cope. Cal.
Mesoteras kerrianus Cope. N. C. —
Total number of species, ... 52

EXPLANATION OF PLATES.

PLATE XX,—*Choneziphius semijunctus* Cope. One-tenth natural size. From photographs of the type in the Museum of Charleston, S. C., taken by Lieut. Vogdes, U. S. A. Fig. 1. Cranium from above; 2, cranium from below; 3, extremity of the mandible, with teeth.

PLATE XXI.—*Delphinapterus leucas* Pallas. One-thirteenth natural size. From a skeleton in the Museum of the Academy of Natural Sciences of Philadelphia, obtained by Dr. I. I. Hayes, from Baffin's Bay. Type of *Beluga concreta* Cope.

PLATE XXII.—*Cetotherium cephalus* Cope. Restoration, one-eighteenth natural size; the portions shaded are the actual specimens of one individual found in the Miocene of Maryland, and now in the Museum of the Academy of Natural Sciences of Philadelphia. Described by E. D. Cope in its Proceedings, 1867, p. 148.

PLATE XXIII.—*Balæna cisarctica* Cope. Type specimen as mounted in the Museum of the Academy of Natural Sciences of Philadelphia; one-thirty-seventh natural size. Fig. 1, side view; Figs. 2, 3, 4, periotic bones from side, end, and below; Fig. 5, cervical vertebræ, oblique inferior view.

THE CONCRESCENCE THEORY OF THE VERTEBRATE EMBRYO.

BY CHARLES-SEDGWICK MINOT.

(Continued from page 516).

The Meroblastic Embryo.—Considerations of practical convenience have led to the custom of distinguishing in the development of meroblastic ova the embryonic from the extra-embryonic portions. The distinction is in reality entirely arbitrary, for the whole of the ovum is included, morphologically speaking, within the body of the embryo. Custom has led to designating the two parts as the embryo and the yolk; the student should be careful not to allow himself to be misled by these terms. In the laboratory it is a general practice to remove the so-called "embryo" from the yolk, and in doing this the entodermic cavity loses its inferior wall, to wit, the entodermic yolk. Let the relations be represented by the accompanying diagram, the embryo being drawn very much too large in proportion to the yolk for the sake of clearness. Suppose the layers to be cut through on the lines, $x\,x'$; we could then remove the embryonic portion. This is what is actually done in practice. It is very important to understand clearly that the yolk is part of the embryo, and that our sections usually represent only a torso.

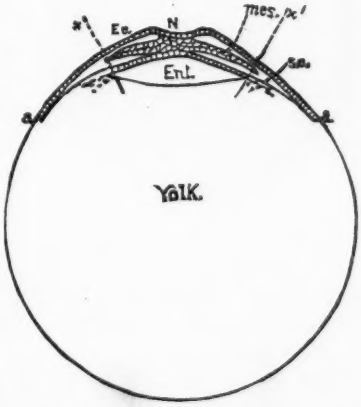


FIG. 10.—Diagram showing the relations of a vertebrate ovum with an embryo in cross-section and a large yolk. *Ec*, ectoderm; *N*, neural groove; *mes*, mesoderm, *s. c.*, segmentation cavity; *Ent*, archenteric cavity; *a*, *a*, ectodermal vein, where the ectoderm is growing over the yolk.

Structure of the primitive streak.—For our purposes it is convenient to give 1°, a general comparative account; 2°, a more detailed description of the mammalian ovum up to the stage with completed primitive streak.

1°. *Vertebrate primitive streak.*—It is advisable to begin with the consideration of the arrangement as we find it in eggs of marsipobranchs, ganoids, and amphibians, since these eggs are probably more primitive in their mode of development than those of other vertebrates. The points of most importance in my judgment are illustrated in Fig. 11, A and B. In A, we have a section through the middle portion of a partly-formed primitive

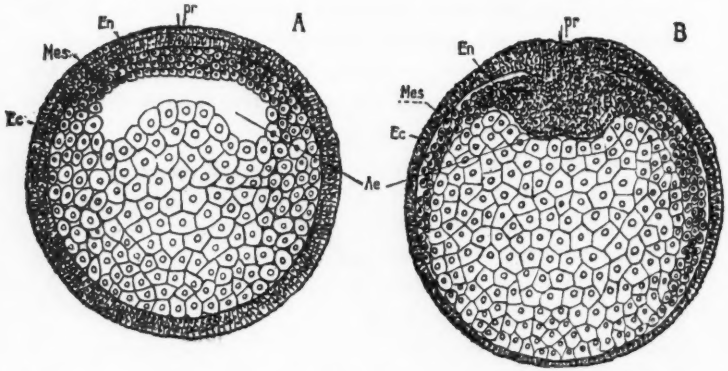


FIG. 11.—Sections of axolotl eggs: after Bellonci. *A*, frontal section somewhat anterior to the blastopore, from an egg in which the archenteron was partly formed, but the anus of Rusconi not delimiated. B, frontal section of an older ovum with well marked but large anus of Rusconi; the section passes just in front of the blastopore. *Ec*, ectoderm; *En*, entoderm; *Mes*, Mesoderm; *Ae*, archenteric cavity; *Pr*, primitive streak.

streak of an axolotl, the streak still requiring considerable additions at its hinder end before attaining its full length; the archenteric cavity, *Ae*, is a large space bounded above by an epithelium, *en*, and below by the large mass of yolk-cells; the two-layered ectoderm, *Ec*, everywhere bounds the section; above the archenteron and below the ectoderm lies the accumulation of cells constituting the primitive streak, *pr*; the lateral prolongations, *Mes*, of the streak represent the commencing mesodermic outgrowths; whether the mesoderm grows out from the primitive streak, and

subsequently expands solely by its own proliferation, or whether it receives at its periphery accretions from the yolk-cells, is uncertain. I am inclined to think that the mesoderm does at first receive additions from the yolk. In B we have a similar section, but of an older stage, and through the hind end of the nearly full-grown streak; the general arrangement is the same as in A; we note the following differences: the primitive streak, *Pr*, is very thick, and composed of numerous small cells, and its lateral mesodermic expansions, *Mes*, extend further around the ovum. In both sections we see that the cells of the primitive streak are not marked off from those of the adjoining entoderm. In a longitudinal section, as is illustrated by that of a sturgeon, Fig. 7, *ante*, p. 510, we see that the mesoderm or tissue of the primitive streak runs way forward, and is thickest around the blastopore. The disposition of the parts and the appearance of the cells vary in the three groups we are considering, but for our purpose it is unnecessary to describe these secondary differences. The points essential to note are that the primitive streak is formed by mesoderm, which is accumulated along the line, and is thickest around the blastopore, and which spreads laterally between the ectoderm and entoderm; in the axial region the mesoderm is not separated from the entoderm; the blastopore passes through the thick hind end of the streak.

In elasmobranchs the differentiation of the axial tissues begins in the embryonic rim before concrescence takes place, so that while the type affords peculiarly conclusive evidence of concrescence, it is less convenient for the study of the primitive streak since the hind end of the primitive streak is, as it were, divided, being continued as the embryonic rim right and left. The degree of differentiation varies extremely; in Pristiurus the mesoderm grows out from the embryonic rim; in Scyllium the mesoderm grows out, and the differentiation of the notochord begins; in Torpedo (Rückert, *48*, 101) the myotomes appear in the embryonic rim before concrescence, as in Elacate among teleosts. The relations are further complicated by the advance in development of the axial structures while concrescence is going on, so that, as for in-

stance in Pristiurus, Rabl, *44*, 116-129, the notochord may be differentiated while the mesoderm is still developing in the embryonic rim. The precocious changes in the embryonic rim demand especial attention when the origin of the mesoderm is discussed. The ectoderm, as soon as it becomes one-layered, consists of high cylinder cells. As development progresses the ectoderm thins out except at either side of the axial line. The mesoderm arises from the entoderm, close to the ectental line, and is there quite thick, but as it stretches away it thins out. Now, if it be remembered that the ectental llne becomes the axial line when concrescence takes place it is evident that this mesodermic thickening of the entoderm is in reality axial thickening, and when concrescence takes place it fuses with the corresponding thickening of the opposite side and constitutes an actual axial thickening or true primitive streak; but in elasmobranchs as soon as the anterior axial structures have concresced we find by precocious development that the notochord and medullary groove appears; now, as I have shown elsewhere, the appearance of these structures causes the division of the axial mesoderm into completely separated right and left portions. It is only by keeping the process of concrescence and the precocious development of the parts constantly in mind that we can understand the development in elasmobranchs or compare it rightly with that of other types. From what has been said it is clear that a section of the blastodermic rim from which the mesoderm was just growing out would correspond to half a section of, say, a bird's ovum through the primitive streak, and upon comparison it will be found that all the essential relations are identical.

The structure of the primitive streak in birds has been repeatedly investigated and the subject of much discussion. As the observations of Duval, *17*, *18*, appear to me the most thorough, and as my own preparations have enabled me to confirm many of his statements, I follow in the main that author. Duval's statements have also been verified in many essential points by Zumstein, *69*. Other important authorities to be consulted are Kölliker in both his text-books; His *25*, *28*, *29*, etc.;

Koller, *31;* Disse, *15, 16;* Waldeyer, *64, 65;* M. Braun, *12;* Gasser, *21, 22;* Rauber, *46;* C. Rabl, *44.*

The following description applies to the hen's egg. When the egg is laid the centre of the segmented blasto-disc presents a circular area of lighter color; during the first few hours of incubation this *area pellucida*, as it is called, becomes more distinct; as concrescence goes on the *area pellucida* expands, and the primitive streak appears in it excentrically between the eighth and twelfth hour. By the sixteenth hour the primitive streak has its full length. The rate of development is extremely variable, autumn eggs developing more slowly than spring eggs; the eggs vary also individually, and are moreover much influenced by the temperature of their incubation. For a fuller discussion of these variations see His, *25*, 56–63. Seen from the surface the *area pellucida* with completed streak presents the following features: the *area pellucida, ap,* is considerably elongated and somewhat pear-shaped, being widest at the anterior end of the primitive groove, *pt;* this groove is well marked as a narrow and shallow furrow, which begins some distance from the anterior edge of the area, and ends just before reaching the posterior edge of the area; the front end of the furrow usually bends slightly to the left, but not invariably, as Koller and Rabl have maintained, for it sometimes bends to the right or is quite straight; a line of granules is sometimes noticeable above the primitive groove; they were seen by Dursy, *l. c.*, and are called by Duval, *17*, p. 15, the *filament épiaxial*, compare Gasser, *14*. The

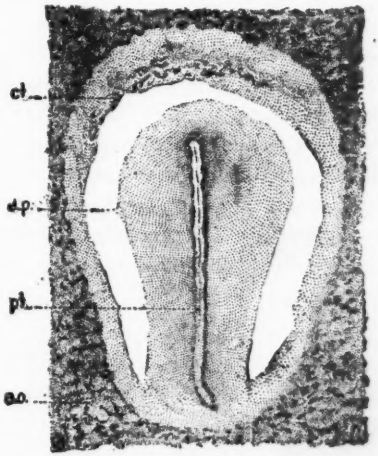


FIG. 12.—Area pellucida of a hen's egg with complete primitive furrow; after Duval. *Ao*, area opaca; *ct*, anterior crescent; *Ap*, area pellucida; *pt*, primitive groove. x 20 diam.

portion of the *area pellucida* immediately around the primitive groove appears slightly darker than the rest. The anterior portion of the pellucida is further distinguished by the anterior crescent, *ct*, the "vordere Aussenfalte" of His, *25*, and other German writers. The anterior crescent is a temporary appearance due, according to Duval, to a series of folds of the entoderm, which forms a curving row of shallow pockets, that, shining through, mark out the crescent. The crescent disappears a little later, and there arises, nearly if not quite in its place, a new fold, the amniotic. The similarity of position has led to the anterior crescent being identified by some authors with the true amniotic fold.

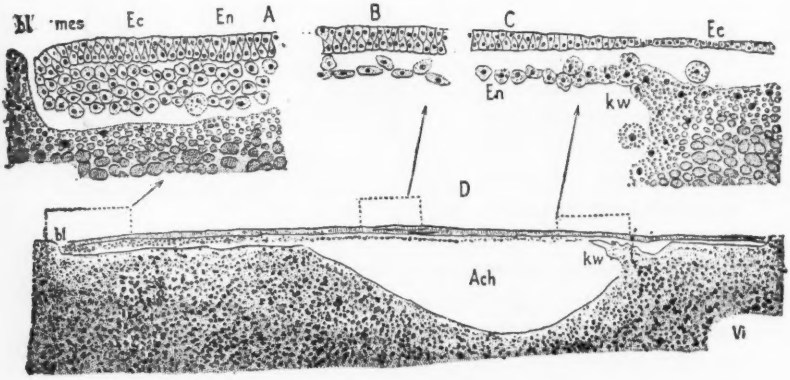


FIG. 13.—Longitudinal section of the region of the primitive streak of a hen's ovum incubated six hours; after Duval. *D*, general view magnified about 40 diameters; *A*, *B*, *C*, details of *D*, with higher magnification; *Ec*, ectoderm; *Mes*, mesoderm; *Ent*, entoderm; *bl*, blastopore; *k w*, germinal wall (keim wall); *Ach*, archenteric cavity.

Longitudinal and transverse sections are very instructive. We begin with the examination of a *longitudinal section* of a somewhat younger stage, in which the blastopore is open. Later the ectoderm closes behind the primitive streak, as already stated, and spreads backward over the yolk. The section shows that the yolk is not divided into cells, although nuclei are scattered through it; the nuclei are represented as black dots in *A* and *C*. The cavity of the archenteron, *Ach*, is enlarged by the formation of a deep pit in the yolk, while the posterior half of the cavity

remains a narrow fissure between the cellular entoderm, *Ent*, and the yolk; the archenteron communicates with the exterior by the blastopore, *bl*. The entoderm is a loosely put together stratum of cells, which passes over anteriorly into a ridge of the yolk in which cells are being produced around the already accumulated nuclei; this ridge, *k w*, is the germinal wall. Posteriorly the cell layers are much thicker, *A*; the ectoderm is clearly differentiated from the underlying cells, which are all more or less alike, though they represent both the entoderm and mesoderm. From this connection and from the fact that the connection between the ectoderm and mesoderm, which is so well known to exist after the primitive streak has attained its full

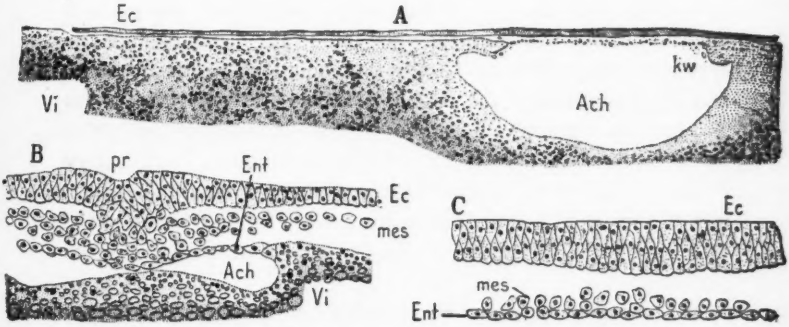


FIG. 14.—Transverse sections of a germinative area with half formed primitive streak; after Duval. *A*, through the anterior region of the area pellucida; *B*, through the primitive streak; *C*, part of *A* enlarged; *Ec*, ectoderm; *Mes*, mesoderm; *Ent*, entoderm; *k w*, germinal wall (Keimwall); *Ach*, archenteric cavity; *Pr*, primitive groove; *Vi*, yolk.

length, Duval concludes that the mesoderm arises primitively from the entoderm. *Transverse sections* afford additional information. The accompanying figure, 14, represents cross sections of a germinal area the primitive streak of which has attained about one-half its full length. The first section, Fig. 14, *A*, passes through the anterior region of the area pellucida; it shows the large cavern, *Ach*, of the archenteron hollowed out in the yolk; the entoderm, *Ent*, above the cavity is a thin layer of cells, connected laterally with a projecting shelf of yolk, *k w* (the *bourrelet entodermo-vitellin* of Duval), which is rich in nuclei, and subse-

quently expands very far and acquires a more cellular character; this shelf is the commencement, therefore, of the *Keimwall* of German writers. Immediately above the entoderm and intimately connected with it are a few cells which belong to the mesoderm, *C, Mes;* the ectoderm is quite thick, *C, Ec,* and consists of high columnar cells; towards its periphery the ectoderm thins out, and its edge rests upon the yolk, with which it has no connection. In the region of the primitive streak, Fig. 14, *B,* the fundamental relations are the same, but there are important differences to note. The entodermic cavity, *Ach,* is very much smaller; the mesoderm is much thicker, and in the axial region fuses with both the ectoderm and entoderm, thus forming the *Achsenstrang* (axial cord) of German writers; the mesoderm also spreads out over the yolk far beyond the archenteric cavity, about one-third of the way from the axial line to the distal edge of the ectoderm; the ectoderm is disposed about as in the previous section, except that in the centre it merges into the mesoderm and presents externally a small notch corresponding to the section of the primitive groove. There appears to me no satisfactory evidence that the mesoderm receives, as some writers have maintained, peripheral additions from the yolk. In both sections the yolk under the blastoderm contains numerous nuclei near its surface.

Modifications very soon ensue in the Sauropsida (birds and reptiles) by which the disposition of the mesoderm is considerably changed, especially in three respects, namely: by the appearance of the so-called head process (Kopffortsatz), by the axial connection of the mesoderm with the ectoderm, and by its losing in part its connection with the mesoderm. During these changes the archenteron expands rapidly, the archenteron expands rapidly, the entoderm becomes very thin in the region of the are apellucida, and passes more and more abruptly, as development progresses, into the so-called germinal wall of the area opaca; finally the ectoderm becomes thinner peripherally; so that the axial thicker part is gradually marked off more and more abruptly. Sections of a stage with a primitive groove at its maximum,—a stage which is usually found towards the end of the first day of incu-

bation,—show three changes clearly. A cross section through the area opaca in front of the area pellucida shows the thin ectoderm, the thick cellular entoderm overlying the archenteric cavity and charged with yolk granules; the entodermic nuclei are very variable in form and irregular in distribution; the cell boundaries are indistinct. There is no mesoderm. A cross section near the front of the area pellucida likewise shows only ectoderm and entoderm; the former is a high cylinder epithelium over the area pellucida and thins out towards the opaca on each side; the latter is a thin layer over the area pellucida, and passes quickly but not abruptly into the very thick yolk-bearing entoderm (or Keimwall) of the area opaca. Sections a short distance in front of the primitive groove show that the head process (*Kopffortsatz*) is a forward prolongation of the primitive streak and consists of an

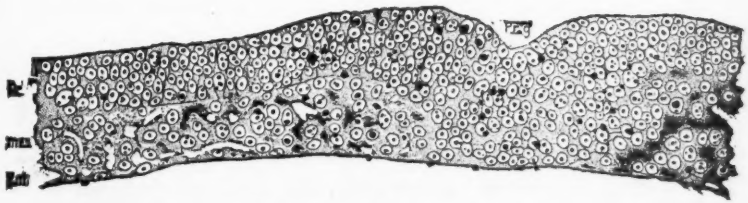


FIG. 15.—Transverse section of the anterior region of a fully developed primitive streak of a hen's ovum. *Ec*, ectoderm; *mes*, mesoderm; *Ent*, entoderm; *Pr. g*, primitive groove. The black dots represent yolk granules.

axial accumulation of the mesodermic cells, fused with the entoderm, and having broad extensions sideways to form the mesoderm beeween the outer and inner germ-layers; the lateral portions of the mesoderm have no connection with the outer germ-layers, and at its distal edge the mesoderm thins out and rests upon the entoderm of the opaca, but without being connected with it; I cannot find any satisfactory evidence that it receives any additions from the opaca entoderm, as many authors have maintained. The ectoderm in the region of the Kopffortsatz resembles that further forward, but it very soon shows a faint median furrow, the so-called dorsal groove (*Rückenrinne*), which is the commencement of the medullary groove. In the anterior half of the primitive streak the relations are similar to those in the head process, ex-

cept that the ectoderm shows the primitive groove, Fig. 15, and is fused with the axial cord (*Achsenstrang*) of the mesoderm, so that in the axial region the three layers are united. In the posterior region of the primitive groove the connection of the mesoderm with the inner germ layer is dissolved, but the connection with the entoderm is retained. Behind the primitive groove the mesoderm extends, but lies free between the ectoderm and entoderm. To recapitulate:—There is a long axial mesodermic thickening, which has the primitive groove over its posterior two-thirds; the thickening in front of the groove is united with the entoderm and is called the head process; the thickening under the front half of the groove is united with both the ectoderm and entoderm; the thickening under the hind half of the groove is united only with the entoderm; it is to be remembered that the mesoderm arises from the entoderm, and its connection with the ectoderm is, it seems to me, to be considered secondary.

A comparative examination of the primitive streak, as described for various classes in the preceding pages, shows that it has a remarkable uniformity of organization. In all types it consists of an axial accumulation of mesodermic cells; this mesodermal axial cord overlies the archenteron, and sends out mesodermic tissue in a widening sheet between the ectoderm and entoderm, headwards, sideways, and backwards; the mesoderm is thickest posteriorly, *i. e.*, in the region of the blastopore; when it first appears it is intimately connected with the entoderm except in the neighborhood of the blastopore, where both entoderm and mesoderm unite with ectoderm. The mesoderm constitutes an axial mass, and offers no trace of a bilateral division or origin. Such a division is produced secondarily by the meeting of the medullary and notochordal grooves. The ectoderm in the region of the primitive streak consists of high cylinder cells, but it gradually thins out toward the embryonic rim. The entoderm on the dorsal side of the archenteron consists of discrete cells, which soon acquire a distinctly epithelial arrangement; laterally and in front it passes over into the yolk, which may be cellular or a multinucleate mass. These features recur in all the types we have studied, though the variations are very great. In the imme-

diately following stages there is a rapid expansion of the mesoderm, in all directions, and also an expansion of the archenteric cavity, which is especially noticeable in meroblastic ova. The relations of the blastopore are discussed below.

2°. *Mammalian primitive streak.*—The description of the primitive streak has to be preceded by an account of the changes in the blastodermic vesicle from the close of segmentation to the appearance of the primitive streak.

Mammalian blastodermic vesicle.—After the close of segmentation we find that the inner mass becomes flattened out, and in the region it occupies we can distinguish three layers of cells, as previously described, *first*, counting from the outside the thin layer of cells known as Rauber's "Deckschicht;" *second*, a middle layer of cylindrical cells, which becomes the ectoderm; *third*, an inmost layer of thin flattened cells, which belong to the entoderm; the "Deckschicht" continues round the whole vesicle as a single layer; the others layers do not so continue.

The next step in development is the formation of a second layer which spreads out in all directions from the region of the inner mass; hence as far as the new layer reaches the blastodermic vesicle becomes two-layered. Meanwhile the "Deckschicht" disappears, leaving two layers in the region of the inner mass; it is to be remarked that the "Deckschicht" is retained in certain rodents, undergoing special modification as described in the section on inversion of the germ-layers. The stage in which the vesicle is partly two-layered, while the "Deckschicht" is still present, is exemplified in Fig. 16.

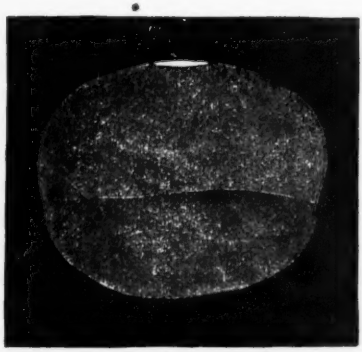


FIG. 16.—Blastodermic vesicle of a rabbit of seven days. *ag*, area germinativa or embryonic shield; *ge*, line, above which the vesicle is two layered.

Blastocyst of the rabbit of six days.—The development is ex-

ceedingly variable, so that exact times cannot be given. The general appearance is illustrated by Fig. 16. from Kölliker. The vesicle figured was 4.4 mm. in length; the envelopes of the ovum are not shown, though they were still present; at the upper pole is the small embryonic shield, corresponding in position to the inner mass; it is marked out by the greater thickness of the walls of the vesicle; the developing second layer extends over more than half the vesicle, reaching to the line *ge*.

The following is a summary of Ed. van Beneden's description, *2*, 185-200, of the blastodermic vesicle of a rabbit at 6 days, 1½ hours after coitus. The vesicle measured 3.2 mm. in diameter; it was nearly spherical; the wall of one hemisphere consisted of one layer of cells; the other hemisphere had two layers of cells, and besides in its central portion a third layer intervening between the other two. The area with three layers van Beneden designates as the *tache embryonnaire;* it showed no trace of the primitive streak; it was oval in outline, and had one point, which the author identifies as Hensen's knot, where the layers adhere together closely. Transverse sections show that the outermost layer of cells is a low cylinder epithelium, which at the edge of the area passes into a thin epithelium quite abruptly; it corresponds to Rauber's "*Deckschicht*," and has been said by him to flatten out and disappear, leaving the cells underneath as the outer layer of the embryonic vesicle in later stages, compare the following paragraph. The cells of the innermost layer are thin and wide; they are called the hypoblast (entoderm) by van Beneden; the cells themselves have round nuclei, around each of which is accumulated a court of granular protoplasm; the adjacent courts are connected by a coarse meshwork of protoplasmic threads; treatment with nitrate of silver brings out the cell boundaries, and divides the reticulum into polygonal areas. The cells of the present outermost layer have distinct boundaries and contain granules, and long bacilliform bodies, which van Beneden saw also in the fresh specimens, and found to be constant appearances. Similar bodies are found in the germinal vesicles of sheep, and are held by Bonnet, *10*, to be derived from the uterine milk; the rabbit is not known to have uterine milk. The histo-

logical peculiarities of these two layers remain about the same from the fifth to the eighth day. The middle layer consists of rounded cells with numerous granules; seen from the surface their diameter is greater than that of the cells outside them, but much less than that of the cells underlying them. While we know that the middle layers are ectodermal, it is uncertain whether the inner layer is really entodermal or really belongs with the two outer layers as part of the primitive blastoderm or ectoderm; in the latter case, the true entoderm of the archenteron must arise later, as we must consider probable also for the reason that the primitive streak is not yet formed.

HISTORY OF GARDEN VEGETABLES.

BY E. L. STURTEVANT.

(Continued from p. 332.)

ROCKET SALAD. *Brassica eruca* L.

THIS strong and to most persons offensive plant has been long under culture, and is even now highly esteemed by the Greeks and Turks, who prefer it to any other salad.[1] It was cultivated by the ancient Romans. Albertus Magnus[2] in the thirteenth century speaks of it in gardens; so also does Ruellius[3] in 1536, who uses nearly the present French name, *roqueta.* In 1586 Camerarius[4] says it is planted most abundantly in gardens. In 1726 Townsend[5] says it is not now very common in English gardens, and in 1807 Miller's Dictionary[6] says it has been long rejected. It was in American gardens in 1854 or earlier,[7] and is yet included by Vilmorin[8] among European vegetables.

[1] Walsh. Hort. Trans., VI., 53.
[2] Albertus Magnus. De Veg., Jessen Ed., 1867, 507.
[3] Ruellius. De Nat. Stirp., 1536, 513.
[4] Camerarius. Epit., 1586, 306.
[5] Townsend. Seedsman, 1726, 18.
[6] Miller's Dict., 1807.
[7] Brown. Pat. Off. Rept., 1854.
[8] Vilmorin. Les Pl. Pot., 1883, 541.

Rocket or *Rocket Salad* is called in France, *roquette, cresson de fontaine, salade de vingt-quatre heures;* in Germany, *rauke, senfkohl;* in Flanders, *krapkool;* in Holland, *rakette kruid;* in Italy, *ricola, ruca, ruccola, ruchetta, rucola;* in Spain, *jaramago, oruga, raqueta;* in Portugal, *pinchao;*[8] in Greece, *aromatos, euzomaton, roka;* in Egypt, *djaerdjïr;*[9] in Arabic, *gergyr.*[10]

ROSEMARY. *Rosmarinus officinalis* L.

This aromatic herb, whose leaves are sometimes used for seasoning, had many virtues ascribed to it by Pliny, and it is also mentioned by Dioscorides and Galen. It was also familiar to the Arab physicians of Spain in the thirteenth century, and is mentioned in an Anglo-Saxon herbal of the eleventh century.[11] The first notice I find of its use as a condiment is by Lignamine in 1475,[12] who describes Rosemary as the usual condiment with salted meats. In 1783 it is described by Bryant[13] as so common in gardens as to be known to every one, and it also finds mention in nearly all the earlier botanies. In 1778 Mawe[14] names four varieties, the common narrow-leaved, broad-leaved, the silver-striped, and gold-striped leaved. It was in American gardens in 1806 or earlier.

Rosemary is called in France, *romarin, encensoir, herbe aux couronnes;* in Germany, *rosmarin;* in Flanders and Holland, *rozemarijn;* in Denmark, *rosmarin;* in Italy, *rosmarino;* in Spain, *romero;* in Portugal, *alecrim;*[15] in Greece, *dendrolibanon;*[16] in Arabic, *klyl, aselban,*[17] *vkleelul-jilbal, hasalban-achsir;*[18] in India, *bubureeah,*[19] in Tagalo, *romero.*[20]

[9] Pickering. Ch. Hist., 281.
[10] Delile. Fl. Aeg. Ill.
[11] Pharmacographia, 1879, 488.
[12] Lignamine. De Conserv. Sanitatis, 1475, c. 81, quoted from Pharmacog., l.c.
[13] Bryant. Fl. Diet., 1783, 141.
[14] Mawe. Gard., 1778.
[15] Vilmorin. Les Pl. Pot., 541.
[16] Hogg. *Hooker's Jour. of Bot.*, I., 134.
[17] Delile. Fl. Aeg., Ill.
[18] Birdwood. Veg. Prod. of Bomb., 65, 242.
[19] Speede. Ind. Handb. of Gard., 186.
[20] Pickering. Ch. Hist., 459.

RUE. *Ruta graveolens* L.

The leaves of Rue, although of a strong odor, disagreeable to some people, are occasionally used for seasoning, and the Italians and Greeks are said to eat them in salads. It was formerly in request, and the Romans seem to have appreciated it highly; and Pliny[21] devotes more than a just space in enumerating its virtues, and speaks of wine flavored with Rue as among the viands distributed to the populace by a Roman consul. In the book on cookery by Apicius[22] in the third century we find Rue used among the condiments. In the thirteenth century Albertus Magnus[23] describes Rue among garden esculents, and praises it. At a later period its garden culture is mentioned in the early botanies and in the earlier works on gardening. In 1806 McMahon[24] mentions it among the medicinal herbs for American gardens. Two varieties, the broad-leaved and the narrow-leaved, were known to Burr[25] in 1863, to Mawe[26] in England in 1778, and apparently to Tragus[27] in Germany in 1552.

Rue or *herb grace* is called in France, *rue;* in Germany, *raute, weinraute;* in Holland, *wijnruit;* in Spain, *ruda;*[28] in Norway, *viinrude;*[29] in Italy, *ruta;* in Greece, *peganos;*[30] in Arabia, *schedab;*[31] in India, *satoora, aloodu;*[32] in Japan, *mats kase so.*[33]

RUTA-BAGA. *Brassica napo-brassica.*

The Ruta-bagas of our gardens include two forms, the one with white flesh, the other with yellow. The French call these two classes *chou-navets* and *Ruta-bagas.* The *chou-navet* or *Brassica napo-brassica communis* A. P. DC. has either purple or white

[21] Pliny. Lib., XX., c. 51; XIX., 45.
[22] Apicius. De Opsonibus, Ed. 1709.
[23] Albertus Magnus. De Veg., Jessen Ed., 1867, 148.
[24] McMahon. Am. Gard. Kal., 1806.
[25] Burr. Field and Gard. Veg., 1863, 573.
[26] Mawe. Gard., 1778.
[27] Tragus. De Stirp., 1552, 68.
[28] Vilmorin. Les Pl. Pot., 542.
[29] Schubeler. Culturpf., 117.
[30] Pickering. Ch. Hist., 271.
[31] Forskal. Fl. Aeg. Arab., CXI.
[32] Speede. Ind. Handb. of Gard., 185.
[33] Thunberg. Jap., 180.

roots; the *Ruta-baga* or *B. napo-brassica Ruta-baga* A. P. DC. has a more regular root, round or oval, yellow both without and within.[34] In English nomenclature, while now the two forms are called by a common name, yet formerly the first constituted the *turnip-rooted cabbage*. In 1806 the distinction was retained in the United States, McMahon[35] describing the *turnip-rooted cabbage* and the *Swedish turnip* or *Roota-baga*. As a matter of convenience we shall describe these two classes separately.

The first description of the white-rooted form that I note is by Bauhin[36] in his Prodromus, 1620, and it is named again in his Pinax,[37] 1623, who calls it *napo-brassica*. In 1686, Ray[38] apparently did not know it in England, as he quotes Bauhin's name and description, which states that it is cultivated in Bohemia and is eaten, but Morison[39] in 1669 catalogues it among the plants in the royal gardens. In France it is named by Tournefort,[40] in 1700, *Brassica radice napiformi* or *chou-navet*. In 1778 these were called in England *turnip cabbage with the turnip underground*, and in the United States, in 1806, *turnip-rooted cabbage*, as noted above.[35] There are three varieties described by Vilmorin,[41] one of which is purple at the collar, and apparently these same varieties are named by Noisette[42] in 1829, and the white, and the red-collared by Pirolle[43] in 1824, under the names *chou-navet, chou turnip*, and *chou de Lapland*. This class, as Don[44] says in 1831, is little known in English gardens, though not uncommon in French horticulture.

The Ruta-baga is said by Sinclair, in the account of the system of husbandry in Scotland, to have been introduced into Scotland about 1781–2, and a quotation in the *Gardeners' Chronicle*,[45] says

[34] Decandolle. Mem. on Brassica, 1821, 25.
[35] McMahon. Am. Gard. Kal., 1806.
[36] Bauhin. Prodromus, 1671, 54.
[37] Bauhin. Pin., 1623, 111.
[38] Ray. Hist., 1686, 797.
[39] Morison. Hort. Reg. Bles., 1669, 31.
[40] Tournefort. Inst., 1719, 219.
[41] Vilmorin. Les Pl. Pot., 142.
[42] Noisette. Man., 1829, 349.
[43] Pirolle. L'Hort. Fran., 1824.
[44] Don. Gar. and Bot. Dict., I., 241.
[45] Gard Chron., 1853, 346.

it was introduced into England in 1790. I find no earlier references. It is mentioned in 1806 by McMahon as in American gardens, and in 1817 there is a record of an acre of this crop in Illinois.[46] The vernacular names all indicate an origin in Sweden or Northern Europe. It is called *Swedish turnip* or *Roota-baga* by McMahon in 1806, by Miller's Dictionary in 1807, by Cobbett in 1821, and by other authors to the present time. Decandolle in 1821 calls it *navet jaune*, *navet de Swede*, *chou de Laponie*, and *chou de Suede*. Pirolle in 1824 *Ruta-baga* or *chou navet de Suede*, as does Noisette in 1829. In 1821 Thorburn calls it *Ruta-baga* or *Russian turnip*, and a newspaper writer in 1835[47] calls it *Ruta-baga*, *Swedish turnip*, *Lapland turnip*. The foreign names given by Don in 1831 include many of the above-named and the Italian *navone di Laponia*. Vilmorin,[41] in his Les Plantes Potageres, 1883, describes three varieties, one with a green collar, one with a purple collar, and a third which is early.

The modern names for the species are: In English, *Swedish turnip*, *Ruta-baga;* in England also, *turnip-rooted cabbage and Swede;* in France, *chou-navets*, *chou-rave en terre*, *chou turnep;* in Germany, *kohlrube*, *erd-oder unter-kohlrabi*, *wruekenrube;* in Flanders, *steekrapp;* in Holland, *koolraapen onder den grond;* in Denmark, *roe;* in Italy, *cavalo navone;* in Spain, *col nabo*, *nabicol;* in Portugal, *couve nabo;*[41] in Sweden, *rot-kal;*[48] in India, *lal shulghum*.[49]

SAFFRON. *Crocus sativus* L.

This plant is hardly deserving of mention, as its presence in the kitchen-garden is scarcely ever noted. Saffron, however, as a medicine, condiment, perfume, or dye, has been highly prized by mankind from a remote period. Under the Hebrew name, *carcom*, the plant is alluded to by Solomon; and as *krohos* by Homer, Hippocrates, Theophrastus, and Theocritus. Virgil and Columella mention it, and Cilicia and Sicily are both alluded to by Dioscorides and Pliny as localities celebrated for this drug.

[46] Pat. Of. Rept., 1854, 198.
[47] *Maine Farmer*, May 15, 1845.
[48] Tengborg. Hort. Culin., 1764.
[49] Speede. Ind. Handb. of Gard., 138.

Throughout the middle ages frequent notices are found of its commerce and cultivation. A most interesting resumé of the history of Saffron may be found in the Pharmacographia by Fluckiger and Hanbury.

Saffron is called in France, *safran;* in Germany, *saframpflance;* in Italy, *zafferano;* in Spain, *azafran;*[50] in Greece, *krokos;* in Egyptian, *methaio;*[51] in Arabic, *koorkum zafran;* in Burma, *thauwen;* in Hindustani, *zofran keysur;* in Malay, *saffaron coonyer;* in Persian, *kerkum;* in Sanscrit, *kasmirajamma, kunkuma;* in Tamil, *khoongoomapoo;* in Telegu, *khoonkoomapoo, kukuma.*[52]

SAGE. *Salvia officinalis.*

This is one of the most important occupants of the herb garden, being commonly used for seasoning, and also in domestic medicine. It has been under cultivation from a remote period, and is considered to be the *elelisphakos* of Theophrastus, the *elelisphakon* of Dioscorides, the *salvia* of Pliny, and its medicinal virtues are noted by Oribasius, and others of the early writers on medicine. In the middle ages it found frequent mention, as by Albertus Magnus in the thirteenth century, and the plant and its uses are noticed in nearly all of the early botanies. Although but one variety is now grown in our gardens, yet formerly a number of sorts are noted, the red, green, small, and variegated being named by Worlidge[53] in 1683. Sage was in American gardens in 1806[54] and doubtless long before, and six varieties are described by Burr[55] in 1863, all of which can perhaps be included among the four mentioned in 1683, and all by Mawe in 1778.

Sage is called in France, *sauge officinale, grande sauge, herbe sacree;* in Germany, *salbei;* in Flanders and Holland, *salie;* in Italy, *salvia;* in Spain, *salvia;* in Portugal, *molho;*[56] in Norway,

[50] Vilmorin. Les Pl. Pot., 543.
[51] Pickering. Ch. Hist., 115.
[52] Birdwood. Veg. Rod. of Bomb., 88, 24.
[53] Syst. Hort., by J. W. Gent, 1683, 218.
[54] McMahon. Am. Gard. Kal., 1806.
[55] Burr. Field and Gard. Veg., 1863, 438.
[56] Vilmorin. Les. Pl. Pot., 546.

salvie;[57] in Greece, *sphakos, sphakelos*;[58] in India, *seesta, salbeea*;[59] in Hindustani, *salbia*.[60]

SALSIFY. *Tragopogon porrifolium* L.

In the thirteenth century Albertus Magnus[61] describes a wild plant, *Oculus porce* or *flos campi*, which commentators identify with the salisfy, as having a delectable root, which is eaten, but he makes no mention of cultivation. It is described, but apparently not under kitchen garden culture by Matthiolus in 1570 and 1598,[62] but not mentioned by him in 1558, when he refers to the yellow-flowered species; there is no mention of culture by Camerarius[63] in 1586, but in 1587 Dalechamp[64] says it is planted in gardens. In 1597 Gerarde[65] describes it, but apparently as an inmate of the flower garden. In 1612 Le Jardinier Solitaire speaks of it as under kitchen garden culture in France, and in 1616 Dodonaeus,[66] J. Bauhin[67] in 1651, and Ray[68] in 1686, refer to it as apparently cultivated. After this period its culture seems to have been quite general, as it is referred to in the works on gardening, beginning with Quintyne, in 1693. It was in American gardens prior to 1806. There are no varieties, and the drawings of an early period indicate as improved a root as is now commonly grown.

The *Salisfy* or *oyster plant* is called in France, *salsifis, cercifix, salsifix blanc, barberon;* in Germany, *haferwurzel;* in Flanders, *haverwortel;* in Denmark, *havrerod;* in Italy, *barba di becco, salsifia;* in Spain, *salsifi blanco;* in Portugal, *cercifi;* in Brazil,

[57] Schubeler. Culturpfl., 88.
[58] Hogg. *Hook. Jour. of Bot.*, 1, 134.
[59] Speede. Ind. Handb., of Gard., 182.
[60] Birdwood. Veg. Prod. of Bomb., 66, 242.
[61] Albertus Magnus. De Veg., Jessen Ed., 1867, 546.
[62] Matth. Comm., 1570, 379; Op., 1598, 410; Com., 1558, 270.
[63] Camerarius. Epit., 1586, 313.
[64] Hist. Gen. Lugd., 1587, 1079.
[65] Gerarde. Herb., 1597, 596.
[66] Dodonaeus. Pempt., 1616, 256.
[67] J. Bauhin. Hist., II., 1059.
[68] Ray. Hist., 1686, 252.

cercefin,[69] in Greece, *trihoura*,[70] in Norway, *havrerod*,[71] in the Mauritius, *salsifis*.[72]

The yellow-flowered species, *Tragopogon pratense* L.[73] seems formerly to have been cultivated. The use of the root is noted by Matthiolus in 1558. In 1597 Gerarde notes it as a wild plant of England. In 1640 Parkinson recommends it as excellent for the table, and cultivated for this purpose. Vilmorin, in 1883, also mentions a yellow-flowered form as under occasional culture, but he does not refer it decisively to this botanical species.

SAMPHIRE. *Crithmum maritimum* L.

The shoots of this seaside plant are pickled in vinegar, and it is even an object of garden culture for this purpose. The first mention of its culture that I find is by Quintyne,[74] in France, in 1690; it is again mentioned by Stevenson,[75] in England, in 1765; and its use as a pot-herb by the poor, as well as a pickle, is noticed by Bryant[76] in 1783. It is noticed in American gardens in 1821.[77]

Samphire, Sampier, Sea Fennel, or *Sea Samphier* is called in France, *perce-pierre, baeile, christe marine, crete marine, fenouil des marais, fenouil marin, herbe de St. Pierre, passe-pierre, saxifrage maritime;* in Germany, *meer-fenchel, steinbrech;* in Flanders and Holland, *zeevenkel;* in Italy, *bacicci, erba san-pietro, sassifraga;* in Spain, *hinojo marino, pasa piedra;* in Portugal, *funcho marino*,[78] in Greece, *almura* or *kretamon*.[79]

SAVORY. *Satureja* sp.

But two species of Savory are now included among the cultivated sorts, but it is not long since that four species occurred

[69] Vilmorin. Les. Pl. Pot., 543.
[70] Pickering. Ch. Hist., 625.
[71] Schubeler. Culturpfl., 85.
[72] Bojer. Hort. Maur., 190.
[73] Miller's Dic., 1807. McIntosh. Book of the Gard., II, 228.
[74] Quintyne. Comp. Gard., 1693, 105.
[75] Stevenson. Gard. Kal., 1765, 102.
[76] Bryant. Fl. Diet., 1783, 136.
[77] Cobbett. Am. Gard., 1821.
[78] Vilmorin. Les Pl. Pot., 402.
[79] Pickering. Ch. Hist., 294.

in our books on garden esculents, and yet another by earlier writers. This class of aromatics were known to the ancient Romans, and were referred to under the name of *satureia cunila* and *thymbra*.

The European names given to the *Savory* are: In France, *sarriette;* in Germany, *die saturei;* in Holland, *keul;* in Italy, *sautoreggia;* in Spain, *ajedrea;* in Portugal, *segurelha;* in Russia, *tschaber;* in Denmark, *saer;* in Poland, *ozabi.*[80]

Satureja hortensis L.

This species seems to be the *satureja* of Palladius[81] in the third century, and of Albertus Magnus[82] in the thirteenth, and is mentioned in England by Turner[83] in 1538, which would indicate its presence there at this date. It was also well known to all the earlier botanists, and is mentioned as a common pot-herb by all the earlier writers on gardening. In 1783 Bryant[84] says that besides being used as a pot-herb, it is frequently put into cakes, puddings, sausages, etc. It was in American gardens in 1806 or earlier,[85] and as an escape from gardens is now sparingly found in Ohio, Illinois, Nevada, etc.[86] The whole plant is highly odoriferous, and it is usually preferred to the other species.

Summer Savory is called in France, *sarriette annuelle, sarriete commune, herbe de St. Julien, sadree, savouree;* in Germany, *bohnenkraut, pfefferkraut, kollkraut;* in Flanders and Holland, *boonenkruid;* in Denmark, *sar;* in Italy, *santoreggia;* in Spain, *ajedrea comun, sojulida;* in Portugal, *segurelha;*[87] in Norway, *sar;*[88] in the Mauritius, *sarziette.*[89]

[80] McIntosh. Book of the Gard., II., 238.
[81] Palladius. Lib., III., c. 24.
[82] Albertus Magnus. De Veg., Jessen Ed., 569.
[83] Turner. Libellus, 1538.
[84] Bryant. Fl. Diet., 1783, 143.
[85] McMahon. Am. Gard. Kal., 1806.
[86] Gray. Syn. Flora., II., Pt. I., 358.
[87] Vilmorin. Les Pl. Pot., 544.
[88] Schubeler. Culturpfl., 89.
[89] Bojer. Hort. Maur., 248.

Satureja montana L.

A species known to the earlier botanists, and probably known to the ancient culture, although I do not find it identified with any certainty. It is mentioned in Turner's Herbal in 1562, and this is as far back as we have printed registers; but there can be little doubt but that this, with the summer savory, was much cultivated in far earlier times in England.[90] It was in American gardens in 1806.[85] The uses are the same with the preceding species.

Winter Savory is called in France, *sarriette vivace, sarriette des montagnes;* in Germany, *winter bohnen-oder pfefferkraut;* in Spain, *hisopielo.*[87]

Satureja capitata L.

This species is omitted from our most modern books on gardening, although recorded in American gardens as late as 1863.[91] It is mentioned as under culture in many of the early works on botany and gardening.

Headed Savory is called in France, *thim de Crete.*[92]

Satureja viminea L.

A native of Jamaica, and introduced in Britain in 1783, and has two varieties. It was recorded by Burr,[91] in 1863, as in American gardens, but as little used. It is said to be much used for seasoning in its native country. It is not now recorded as in European cultivation.

Satureja juliana L.

This Savory is mentioned by Gerade,[93] in 1597, as sown in gardens. It is a native of the Mediterranean countries, called in Greece, *ussopo,* in Egyptian, *pesalen.*[94] Its name has disappeared from our seed catalogues.

[90] Miller's Dict., 1807.
[91] Burr. Field and Gard. Veg., 1863.
[92] Tournefort. Inst., 1719, 196.
[93] Gerarde. Herbal, 1507, 461.
[94] Pickering. Ch. Hist., 343.

SAVOY CABBAGE. *Brassica oleracea bullatta* DC.

This race of cabbage is distinguished by the blistered surface of their leaves, and by forming only a loose or little compact head. I am inclined to believe that the heading cabbages of the ancient Romans belonged to this class, as in their descriptions there are no indications of a firm head, and at a later period this form is named as if distinctly Roman. Thus Ruellius[95] in 1536 describes under the name *Romanos* a loose heading sort of cabbage, but does not describe it particularly as a Savoy. This sort probably is the *Brassica italica tenerrima glomerosa flore albo* figured by J. Bauhin[96] in 1651, its origin, judging from the name, being ascribed to Italy, and also figured by Chabraeus,[97] 1677, under the same name, and with the additional names of *Chou d'Italie* and *Chou de Savoye*. In the Adversaria[98] and elsewhere this kind is described as tender, and as not extending to the northern climates. I do not know of this form, so carefully pictured, as existing under culture, and it has doubtless been superseded by better varieties.

In the Savoy class three types are to be seen. The most common is the spherical-headed, next the long-headed or elliptical, and lastly the conical. There are a number of varieties. In 1883 Vilmorin describes fifteen in his Les Plantes Potageres, and names others. In the report of the New York Agricultural Experiment Station for 1886, thirteen varieties are described.

The SPHERICAL-HEADED. This race is the most common, and occurs in various degrees of blistering, and in a large number of varieties. The following synonymy embraces this type:

Brassica crispa. Matth., 1558, 247; Pin., 1561, 162; Cam. epit., 1586, 249; Pancov., 1673, n. 614.

B. alba crispa. Lugd., 1587, I., 520.

B. patula crispa. Sabauda æstiva. Lob. ic., 1501, I., 244; Chabr., 1677, 269.

B. sabauda. Ger., 1537, 247.

B. sabauda crispa. Ger., l. c.

[95] Ruellius. De Natura Stirpium, 1536, 477.
[96] J. Bauhin. Hist., 1651, II., 827.
[97] Chabraeus. Icones et Sciag., 1677, 269.
[98] Pena and Lobel. Adv., 1570, 91.

B. sabauda rugosa. J. Bauh., 1651, II., 828.

The ILLIPTICAL-HEADED. This race has also a syonomy, and has been long known.

Brassica sabauda hiberna. Lob. ic., 1591, I., 244.

B. alba capite oblongo non penitus clauso. C. Bauhin, Phytopin., 1596, 176; Pin., 1623, III.

B. sabauda. Dod. Pempt., 1616, 624.[99]

The CONICAL-HEADED. Of this type I know of but one form, the *Conical Savoy*, the French synonyms *chou milan a tete longue, chou frise pointu*, and *chou milan pain de sucre.* This variety finds mention in French works on gardening in 1824, 1826, and 1829.[100]

The modern names of the Savoy Cabbage are: In France, *choux de milan, chou milan, chou cabus frise, chou cloque, chou de Hollande, chou pancalier, chou de savoie;* in Germany, *wirsing, savoyerkohl, borskohl;* in Flanders and Holland, *savooikool;* in Denmark, *savoykal;* in Italy, *cavolo di milano, verza;* in Spain, *col de milan, col risada, col lombarda;* in Portugal, *saboia;*[101] in India, *sikoree kobee.*[102]

In ancient times it was called: In English, *savoie cole*, Ger., 1597, *savoy cabbage*, Ray, 1686; in France, *chou de savoye*, Lyte, 1586, *choux vers*, Pin., 1561; in Germany, *koel*, Pin., 1561, *krauskol*, Cam. Epit., 1586; in Dutch, *savoy koolen*, Lyte, 1586; in Italy, *cavoli, verza*, Pin., 1561, *cavolo crespo, verza crespa*, Cam. Epit., 1586; in Spain, *colles* or *covves*, Pin., 1561.

A more minute examination would serve to identify nearly all of our sub-varieties with kinds named preceding 1830.

SCARLET RUNNER BEAN. *Phaseolus multiflorus* Willd.

This bean, a native of South America, was described and figured by Cornutus[103] in 1635, under the name *Faseolus puniceo flore;* but it appears in Johnson's edition of Gerarde, 1633. It was first cultivated as an ornamental plant, and the first mention

[99] The figure not clear, but the description is.
[100] LH'ort. Fran., 1824; Petit. Dict. du Jard.. 1826; Noisette, Man., 1829.
[101] Vilmorin. Les Pl. Pot., 1883, 121.
[102] Speede. Ind. Handb. of Gard., 1842, 113.
[103] Cornutus. Canad. Plant., 1635, 184, Fig. 185.

I find of its use as a vegetable is by Townsend[104] in 1726, who says "the cods are eaten sometimes like other kidney beans," and Stevenson,[105] in 1765, gives directions for kitchen-garden culture. In America, in 1806,[106] it was cultivated exclusively for ornament, and first appears in the vegetable garden about 1819.[107] At the present time five varieties are given by Vilmorin, but one of these, the black, I have neither seen nor found recorded for American gardens, and the hybrid is not clearly described.

The synonymy of the different varieties is as below:

I. *Phaseolus flore coccineo.* Ray, 1686, I., 884.

P. multiflorus coccineus. Lam. ex Martens, n. 123.

Large Scarlet Climber. Mawe, 1778.

Haricot d'Espagne rouge. Vilm., 1883, 276.

Scarlet Runner. N. Y. Agr. Exp. Sta. Rept., 1883, n. 56; 1874, n. 89.

II. *Faseolus puniceo flore.* Cornutus, 1635, 184.

Phaseolus indicus flore miniato, semine nigro. Titius, 1654, ex Mart.

P. multiflorus niger. Martens, 1869, n. 121.

Haricot d'Espagne a grain completement noir. Vilm., 1883, 277.

III. *Phaseolus multiflorus bicolor.* Anabida, 1827, ex Martens, 83.

Haricot d'Espagne bicolor. Vilm., 1883, 227.

Painted Lady. N. Y. Agr. Exp. Sta. Rept., 1884, n. 90.

IV. *Phaseolus indicus flore et semine albo.* Titius, 1654, ex Martens.

Phaseolus multiflorus albus. Martens, 1869, 82.

Large White Climber. Mawe, 1778.

White Dutch Runners. Gardiner and Hepburn, 1818, 68.

White or Dutch Runner. N. Y. Agr. Exp. Sta. Rept, 1884, n. 91.

This synonymy establishes the dates at which each variety appeared, and the varieties have kept true since then. The seed of

[104] Townsend. Seedsman, 1726, 83.
[105] Stevenson. Gard. Kal., 1765, 103.
[106] McMahon. Am. Gard. Kal., 1806.
[107] Practical Am. Gard., Baltimore, 1819, 84.

each produces its own variety, unless the blooms have been cross-fertilized. Under these circumstances I have noted the Scarlet Runner seed producing the White Runner; the White Runner seed producing the Scarlet Runner, the Painted Lady, and another form which I think is the Haricot d'Espagne hybrid of Vilmorin. There have appeared in these crossed plants no intermediate types whatsoever, and I believe that the mixed seed tends to revert ultimately to the original variety, having purged itself of its contamination.

The names under which the species is known are: In France, *haricot d'Espagne;* in Germany, *arabische bohne;* in Holland, *tursche boon;* in Italy, *fagivolo di Spagna;*[108] in India, *lal loba* or *lal lobeea.*[109]

SCOLYMUS. *Scolymus hispanicus* L.

This plant is supposed by authors to be the *skolumus* and *leimonia* of Theophrastus, 322 B.C., and its root recorded as edible; the *scolymus* of Pliny A.D. 79, recorded as a food plant. The wild plant was seen in Portugal and Spain by Clusius[110] in 1576. The plant was described by Gerarde[111] in England in 1597, but he does not appear to have grown it. It was in the botanic gardens at Oxford[112] in 1658, but receives no other than a quoted mention from Clusius by Ray[113] in 1686. It appears not to have been in English culture in 1778,[114] nor in 1807,[112] and in 1869 is recorded as a new vegetable.[115] In 1597 Gerarde[111] mentions its culture in Holland, and in 1616 Dodonaeus[116] says it was planted in Belgian gardens. In France, in 1882, it is said not to be under culture, but that its long fleshy root is used as a kitchen vegetable in Provence and Languedoc.[117] In 1883 it is included among kitchen esculents by Vilmorin.[118] It is accorded

[108] Vilmorin. Les Pl. Pot., 276.
[109] Speede. Ind. Handb. of Gard., 125.
[110] Clusius. Hisp., 1576, 448; Hist., 1601, 2, 153.
[111] Gerarde. Herb., 1597, 993.
[112] Miller's Dict., 1807.
[113] Ray. Hist., 1686, 257.
[114] Mawe. Gard., 1778.
[115] Gard. Chron., 1869, 584.
[116] Dodonaeus. Pempt., 1616, 726.
[117] Bon Jard. 1882, 566.
[118] Vilmorin. Les Pl. Pot., 1883, 547.

by Burr[119] for American gardens in 1863, and its seed was offered in American seed catalogues of 1882, perhaps a few years earlier.

Scolymus, Spanish scolymus, Spanish oyster plant,[119] or *golden thistle*[120] is called in France, *scolyme d'Espagne cardouille, cardousse, epine jaune;* in Holland, *varkens distel;* in Italy, *barba gentile, cardo scolimo;* in Spain, *escolimo, cardilla;*[118] at Constantinople, by the Greeks, *kephalaggalho.*[121]

SCORZONERA. *Scorzonera hispanica* L.

This plant was not mentioned by Matthiolus[122] in 1558, but in 1570 was described as a new plant, called by the Spaniards scurzonera or scorzonera. In 1576, Lobel[123] says the plant was in French, Belgian and English gardens from Spanish seed. Neither Camerarius[124] in 1586, nor Dalechampius[125] in 1587, nor Bauhin[126] in 1596, nor Clusius[127] in 1601, indicate it as a cultivated plant, and Gerarde,[128] in 1597, calls it a stranger in England, but growing in his garden. In 1612 Le Jardinier Solitaire[129] calls it the best root which can be grown in gardens. The use of the root as a garden vegetable is recorded in England by Meager[130] in 1683, Worlidge[131] in 1683, by Ray[132] in 1686, etc. Quintyne[133] in France, in 1690, calls it "one of our chiefest roots." Its cultivation does not, therefore, extend back to the sixteenth century. No varieties are recorded under culture. It was in American gardens in 1806.

The *black oyster plant, black salsify, Spanish salsify, or scorzonera,* is called in France, *scorsonere, scorzonere d'Espagne, corcionnaire, ecorce noire, salsifis noir;* in Germany, *scorsoner, schwarz-*

[119] Burr. Field and Gard. Veg., 1863, 94.
[120] Vilmorin. The Veg. Gard., 1885, 249.
[121] Forskal. Fl. Aeg., XXX.
[122] Matth. Com., 1558; 1570, 370; 1598, 409.
[123] Lobel. Obs., 1576, 298.
[124] Camerarius. Epit., 1586, 314.
[125] Hist. Gen. Lugd., 1587, 1206.
[126] Bauhin. Phytopin., 1596, 537.
[127] Clusius. Hist., 1601, II., 137.
[128] Gerarde. Herb., 1596, 597.
[129] Le Jard. Solit., 1612, 210.
[130] The Eng. Gard. 1683, 61.
[131] Syst. Hort., by J. W. Gent, 1683, 186.
[132] Ray. Hist., 1686, 248.
[133] Quintyne. Comp. Gard., 1693, 200.

wurzel; in Flanders and Holland, *schorseneel;* in Denmark, *schorsenerrod;* in Italy, *scorzonera;* in Spain, *escorzonera, salsifi nero;* in Portugal, *escorcioneira;*[134] in Norway, *skorsoneerrod.*[135]

SCURVY GRASS. *Cochlearia officinalis* L.

The wild plant, as an antiscorbutic salad, has long been in request, and received especial commendation in Holland, where, on account of its abundance, it does not seem to have been cultivated. In 1586 it is mentioned as common in gardens by Camerarius;[136] in 1597 it was grown in England by Gerarde[137] and a few others; in 1598 it was only found in gardens in Germany;[138] in 1616 recorded in the gardens of Brabant by Dodonaeus.[139] In 1686 called the Garden Scurvy by Ray.[140] In the United States it is recorded among garden vegetables by Burr[141] in 1863.

Scurvy Grass is called in France, *cochlearia officinal, herbe au scorbut, herbe aux cuillers;* in Germany, *loffelkraut;* in Flanders, *lepelkruyd;* in Holland, *lepelblad;* in Denmark, *kokleare;* in Italy and Spain, *coclearia;* in Portugal, *cochlearia;*[142] in Norway, *cochleare.*[143]

SEA KALE. *Crambe maritima* L.

Although this plant is recorded as wild on the coast of Britain, and as fit for food, by Pena and Lobel,[144] Dalechampius,[145] Gerarde,[146] and Ray,[147] yet it was brought into English culture from Italy[148] a few years preceding 1765, and the seed sold at a

[134] Vilmorin. Les Pl. Pot., 548.
[135] Schubeler. Culturpflanz., 85.
[136] Camerarius. Epit., 1586, 271.
[137] Gerarde. Herb., 1597, 324.
[138] Matth. Op., 1598, 381.
[139] Dodonaeus. Pempt., 1616, 593.
[140] Ray. Hist., 1686, 432.
[141] Burr. Field and Gard. Veg., 1863, 397.
[142] Vilmorin. Les Pl. Pot., 158.
[143] Schubeler. Culturpfl., 102.
[144] Pena and Lobel. Adv., 1570, 92.
[145] Hist. Gen. Lugd., 1587, 526.
[146] Gerarde. Herbal, 248.
[147] Ray. Hist., 1686, 838.
[148] Stevenson. Gard. Kal., 1765, 22.

high price as a rarity. In 1778[149] it is said to "be now cultivated in many gardens as a choice esculent," and in 1795[150] it was advertised in the London market. According to Heuze[151] it was first cultivated in France by Quintyne, the gardener to Louis XIV., but I do not find it mentioned in my edition of Quintyne of 1693; it, however, is mentioned in the French works on gardening of 1824[152] and onward. The Sea Kale is named in American gardens in 1806,[153] and by seedsmen in 1829 and onwards, and in 1809 is recorded as cultivated near Boston, and introduced to the public in 1813.[154] At the Mauritius it was cultivated in 1837.[155] It is even now but rarely grown in the United States. There are no varieties.

Sea Kale or *beach-cole* is called in France, *crambe, chou marin;* in Germany, *meer-kohl, see-kohl;* in Flanders and Holland, *zeekool, meerkool;* in Denmark, *strandkaal;* in Spain, *soldanela maritima, crambe, col marino;*[156] in Italy, *crambe marina.*[157]

SHALLOT. *Allium ascalonicum* L.

The *askalonion krommoon* of Theophrastus, and the *cepa ascalonia* of Pliny, are usually supposed to be our Shallot, but this identity can scarcely be claimed as assurred. It is not established that it occurs in a wild state, and Decandolle is inclined to believe it a form of *A. cepa* or onion.[158] It is mentioned and figured in nearly all the early botanies, and many repeat the statement of Pliny that it came from Ascalon, a town in Syria, whence the name. Indeed, Michaud, in his History of the Crusades, says that our gardens owe to the holy wars Shallots, which take their name from Ascalon.[159] Amatus Lusitanus,[160] in 1554, gives

[149] Mawe. Gard., 1778.
[150] *Times*, Apr., 30, 1795, quoted from Gard. Chron., May 15, 1886, 626.
[151] Heuze. Les Pl. Alim., II., 667.
[152] L'Hort. Franc., 1824; Noisette, Man., 1859, etc.
[153] McMahon. Am. Gard. Kal., 1806.
[154] Mass. Agr. Reposit., 1814, 247.
[155] Bojer. Hort. Maurit., 1837, 16.
[156] Vilmorin. Les Pl. Pot., 1883, 192.
[157] McIntosh. Book of the Gard., II., 116.
[158] Decandolle. Orig. Des Pl. Cult., 56.
[159] Michaud. Hist. of the Crusades, 1853, III., 329.
[160] Amatus Lusitanus, in Diosc., 1554, 287.

Spanish, Italian, French, and German names, which goes to show its culture in these countries. In England, they are said to be cultivated in 1633,[161] but McIntosh[162] says they were introduced in 1548, but they do not seem to have been known to Gerarde in 1597. In 1633, Worlidge[163] says "eschalots are now from France become an English condiment." They are enumerated for American gardens in 1806.[164] Vilmorin[165] mentions one variety with seven sub-varieties little differing.

The *Shallot* or *eschalot* is called in France, *eschalote, chalote, ail sterile;* in Germany, *schalotte, eschlauch;* in Flanders and Holland, *sjalot;* in Denmark, *skalottelog;* in Italy, *scalogno;* in Spain, *chalote, escaluna;* in Portugal, *eschalota;*[165] in Norway, *skalotlog;*[166] in the Mauritius, *echallotte;*[167] in China, *hiai;*[168] in Cochinchina, *cay nen;*[169] in India, *gundhuna, gudheenk.*[170]

AN AMERICAN TERRESTRIAL LEECH.

BY S. A. FORBES.

ALTHOUGH leeches are normally aquatic worms, terrestrial species of various genera occur in many parts of the world—Ceylon, Java, Summatra, Australia, Japan, Chili, and Brazil—and some properly aquatic leeches (*Trocheta subviridis* of Europe, for example) leave the water in pursuit of earthworms and other prey. I cannot find, however, that either the terrestrial habitat or the earthworm habit has been reported for any North American leech—a fact which gives especial interest to a hitherto unnoticed species occurring commonly in Illinois, and found, so far as known, only in moist earth.

[161] Miller's Dict., 1807.
[162] McIntosh. Book of the Gard.
[163] Syst. Hort., by J. W. Gent, 1683, 193.
[164] McMahon. Am. Gard. Kal., 1806, 190.
[165] Vilmorin. Les Pl. Pot., 200.
[166] Schubeler. Culturpf., 53.
[167] Bojer. Hort. Maurit., 347.
[168] Smith. Mat. Med. of China, 7.
[169] Loureiro. Cochinch., 202.
[170] Speede. Ind. Handb. of Gard., 159.

This terrestrial leech was first obtained by me in April, 1876, at Normal, McLean county, Illinois, where it was dug up in a house garden about a dozen rods from the nearest rivulet. An example sent the following year to Prof. A. E. Verrill, with some remarks on its superficial characters, was by him identified, provisionally and with some hesitation, as his *Semiscolex grandis*, originally described[1] from three aquatic individuals obtained from Lake Huron and Lake Superior and a river in Connecticut. I have now, however, fifty-six specimens of this leech, all from the earth in central Illinois, sometimes half a mile or more from water, and representing collections made at different times from April, 1876, to June, 1890; while, on the other hand, it has not once occurred in the course of a large amount of aquatic work done in the same regions during these fifteen years. It has, moreover, constant characters which clearly distinguish it from *Semiscolex grandis*, as far as one may judge by a comparison with Verrill's description, and I do not doubt that it is undescribed. Its only known food is earthworms of various genera, and these it swallows entire—as I have repeatedly found by dissection, and demonstrated likewise by feeding experiments on leeches in captivity. Indeed, my serial sections have this peculiarity: that they present the structure of three worms in one section—that of the leech itself and of two earthworms in its stomach.

From the fact that all my specimens were obtained during the early months of the year—from March to June—it is probable that this leech, like the earthworm, penetrates to considerable depths during the midsummer drouths.

DIAGNOSIS: *Semiscolex terrestris*, n. sp. This is one of the largest of our leeches, my contracted alcoholic specimens reaching a length of seven inches, a width of three-fourths, and a depth of three-eighths of an inch. In form, it is heaviest posteriorly, be-

[1] Synopsis of the North American Fresh-Water Leeches. By A. E. Verrill. U. S. Commission of Fish and Fisheries. Part II. Report of the Commissioner for 1872 and 1873, p. 672 (Published in 1874.) This species clearly belongs to Kinberg's genus Semiscolex, but on the other hand there seems little, except the very rudimentary condition of the pharyngeal jaws, to exclude it from Aulastoma, Moqu. (See Diesing, Systema Helminthum, Vol. I., p. 461; and Apathy, Süsswasser-Hirudineen, in Zoologische Jahrbücher, Band III., p. 793), but in the absence of material for a comparison of these genera, I have followed Verrill in using Kinberg's name.

ing widest at about the eighth annulus in front of the acetabulum, but tapering very gradually, or scarcely at all, thence forward to the antierior fourth, and thence more rapidly to the mouth. Its transverse section is depressed oval, flattened beneath the margins of the body obtuse.

The color is sooty drab, varying to plumbeous black, somewhat lighter beneath, uniform in tint, and quite without spots or mottlings of any sort. A darker median longitudinal stripe, very conspicuous and well defined, is almost invariably present; a paler marginal stripe, often approaching buff, little less constantly so, and a ventral submarginal stripe of the same color as the dorsal one, likewise quite frequent. The surface is everywhere smooth, and I find no external trace of segmental papillæ.

There are ninety-nine complete annuli from the mouth to the posterior sucker, four imperfect annuli in the cephalic lobe, and one such just before the vent—104 in all. All the perfect annuli are very distinct, except the first two, which, while well distinguished dorsally, are almost completely fused beneath to form the posterior border of the mouth. In front of the first annulus is the upper lip, divided by a delicate median groove. There are, consequently, eleven such grooves meeting the margin of the mouth, its posterior boundary being formed by the undivided ventral portion of the fifth annulus. The eyes are ten in number, placed upon the first, second, third, fifth, and eighth annuli, representing somites one to five. The acetabulum is broad oval, wider than long, and measures about ten mm. in its greatest diameter. The vent is large and surrounded by irregular radiating grooves.

The first nephridial pore is at the anterior margin of the tenth complete annulus—the fourteenth in all—and the last or seventeenth pore at the anterior margin of the ninetieth ventral annulus—the ninety-fourth of the full series. These pores open on the ventral surface just within the dark ventral line, and consequently at some little distance from the margin of the body. The male sexual opening is on the posterior part of the twenty-eighth entire annulus, and the female opening on the thirty third.

Within the buccal cavity is a prominent circular fold. Maxillæ three, rudimentary, distinguishable only in sections, with an ill-

defined armature of teeth. The pharynx presents ten to fifteen longitudinal folds, the number varying in different parts—the average twelve or thirteen.

I have seen no specimens of *Semiscolex grandis* Verrill, but draw from the author's description distinctions in the number of annulations ("about ninety" in *grandis*), the markings of the upper lip, the positions of the sexual orifices (in *grandis* in the twenty-fifth and thirtieth annuli respectively), and in the color markings—*grandis* being without stripes, and spotted or blotched with dark, in Verrill's specimens.

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General Notes.

GEOGRAPHY AND TRAVEL.

Asia.—The Great Central Trade Route.—Mr. Mark S. Bell (Proc. Roy. Geog., Feb., 1890) contributes a lengthened and interesting account of his journey along the Great Central Trade Route, which leads from Peking to the remote province of Kashgaria. Two routes connect the east of China with Kashgaria, viz: The Alashan route, along which Mr. Younghusband was the first Englishman to travel, and the above-mentioned Great Central Trade Route, traversed by Mr. Bell in 1887. The latter route was gone over in 1874–'75 by Colonel Losnoffsky, who reported that it represented all conditions for becoming the most important artery between Russia and China. It is by no means the straightest route possible, since it first trends considerably to the south to the Wei valley, and then proceeds northwestward to the line of Chinese towns of the province of Kansu. From Peking to Paw-Ting-Fu (218 miles) the road passes over an alluvial plain; thence to Khavailu (157 miles) it lies upon the hills between Chili and Shansi; rises to a height of 4500 feet, and then descends to Tai-Yuen-Fu, the capital of Shansi. The road is entirely on metal, and from Khavailu to Si-Ngan-Fu, the capital of Shensi, consists of nothing more than ruts at the bottom of a gully in the pliable loess of the district. Tai-Yuen-Fu has a population of 5,000, and its nearest port is Tientsin. From Tai-Yuen-Fu to Ping-Yong-Fu (185 miles) the road passes down the valley of Fuen-Ho. Ping-Yong-Fu has a population of about 20,000; between it and Si-Ngan-Fu, the capital of Shensi, intervene 253 miles, still over the loess. The last-named city was the capital of China for more than 2,000 years, from 1122 B.C. to 1127 A.D. The Yellow River is crossed at Tung-Kwan, 93 miles before reaching Si-Ngan-Fu. Tung-Kwan is a very important place, since it is situated on the main line of traffic between the east and west of China at the point where that line is crossed by the chief route from the southeast to the northwest of the kingdom. No commercial route of importance crosses the Hoang-Ho north of Tung-Kwan. With such roads as have been described, and no railways, it may well be conceived that land-carriage in China is very costly—in practice, 30 miles upon land is in expense equal to 600 to 800 miles of water-carriage. The province of

Shensi is in great part a vast wheat field, and is exceedingly rich in coal, iron, and rock-salt. From Singan-Fu to Lan-Chau-Fu, the capital of Kan-Fu, the road traverses a hilly country, usually 6,000 or 7,000 feet above the sea, and sometimes rising to 8,000 or 10,000, for a distance of 449 miles. Kan-Fu is, as it were, a wedge of China driven to the northwest between Mongolia and Kashgaria, from which it is, however, separated by a portion of the desert of Gobi. Formerly it joined the best portion of Tangut, which was destroyed by Genghis or Chenghz-Khan. From that period until now it has formed an integral portion of the Chinese Empire, and its importance has been recognized by all Chinese dignasties. The great wall was carried northwards to Kia-Yu-Kwan, 500 miles to the north of the capital, Lan-Chau-Fu, with a view to its protection. Previous to the Mohammedan rebellion, during which Kashgaria was for awhile independent under the rule of Yakub Beg, the population of Kansu was about 1,500,000, but during the wars which ensued before that rebellion was finally squelched the inhabitants were reduced to some 200,000, and all settlements except a few of the largest walled towns were deserted. The Mohammedans inspired the greatest fear in the Chinese settlers, who fled before them almost without resistance. It is a common mistake to suppose that the rebellion was finally put down by the bravery of the Chinese troops, whereas the most potent weapons were really bribery, the starvations of the garrisons of the town, and the distributions of buttons of rank to traitorous leaders. The recovery of Kansu is at present but very partial. Only the richest oases are in cultivation. The population is exceedingly degraded, opium-smoking is almost universal, young girls are regularly sold. Sodomy is common, and during the rebellion cannibalism was resorted to. From Lan-Chau-Fu to Urumtsi, which the Chinese have made the strategic centre of their new province of Kashgaria, thirteen hundred miles have still to be traversed. The Wei, an important tributary of the Yellow River from the west, is crossed at Sien-Yang-Nsien, where it is one hundred and fifty yards wide. One of the chief graneries of Lan-Chau-Fu, which is a town of 40,000 inhabitants, has fine shops, and is in trade with Russia, is An-Ting-Nsien, at the junction of three valleys, and the others are the valleys of Ho- and Sing-Ning. Lan-Chau-Fu stands at an elevation of 5,500 feet, and the Yellow River is here 250 yards wide. Comparatively easy roads lead from Lan-Chau to Lhassa, the sacred capital of Tibet. The hilly western districts of the kingdom of Tangut did not become subject to China until about 1718. The native Tanguts much resemble the gypsies. To Su-Chau-Fu (482 miles) the road

traverses for a portion of the distance a narrow wedge of cultivation intervening between the Nan-Shan mountains and the desert, but the last portion of the way passes over a barren salt plain or on low hills. An elevation of 9,000 feet is reached from two places. Along the cultivated strips coal is plentiful; the main crops are various kinds of millets. After leaving Lan-Chau the pigs in the villages are as numerous as the men. From Sci-Chau to Ngan-Si-Fu, on the edge of the actual desert of Gobi, is 178 miles; and the town of Hami, on a small rich oasis, is 240 miles further. From Hami to Peking there is a camel route, which can be traversed by those animals in 70 to 80 days, but this is only used for the conveyance of war material. To reach Urumtsi (408 miles) the Tian-Shan mountains must be crossed at their easy easternmost pass, at an elevation of 9,000 feet. There are some fertile oases on the way. At this point Mr. Bell diverged to Tok-Sien, the most eastern town of Yakub Beg's former domain, 103 miles from Urumtsi, and on the opposite side of the Tian-Shan mountains. Between this point and Karashahar (150 miles) Lake Baghrash, a fresh-water lake with an abundance of fish, is passed. The whole of this eastern portion of Chinese Turkestan or Kashgaria is in truth nothing more than a desert, with fertile oases at intervals, each more or less thickly populated and containing a town. As we proceed westward the Turkish element commences to predominate over the Tungusian and the Chinese. Thus the fertile oasis of Khur has 2,000 Turkish families, 50 Tungusian, and 10 Chinese. Aksu, 373 miles beyond Karashahar, is the centre of a district with 180,000 people. From Aksu to Kashgar, in which district there are 160,000 families, is 310 miles. The district of Yarkand is still more populous, and is credited with 300,000 families. From the extreme length of the route from Peking to Kashgaria, the great number of days required to reach the most populated districts from the eastern seaboard, the proximity of those districts to Russian Turkestan, and the identity of race between the subjects of the two countries on both sides of the border, it seems evident that Mr. Bell is correct in his conclusion that unless China promptly constructs a railway to connect this outlying province with her main body, it must fall into the hands of Russia whenever it suits the convenience and finances of the latter to take it. Not that the Turks particularly dislike the Chinese rule, which is rather loose than severe. Several routes lead from Yarkhand to Kashmir and Hindoostan, but the Kilian route is, since the enclosure of the Mustagh, the one universally used. Before reaching Kashmir this route goes over the following passes: Kilian, 17,000 feet; Suget, 17,100 feet; Kara

Kowm, 18,500 feet; Sasir, 17,800 feet; Karawal Dawin, 14,100 feet, Kharching, 17,700 feet above sea. A considerable number of Hindoos have penetrated into Chinese Turkestan and are engaged in commerce.

Polar Regions.—The Geographical Society of Australasia has offered £5000 towards defraying the expenses of an Antarctic Expedition, and to this sum Oscar Dickson has added another £5000. Baron Nordenskjold has lectured upon the desirability of such an expedition before the Swedish Academy, but he will not himself take the command of it.

Dr. Fridtjof Nansen, who has justly achieved celebrity by his success in crossing South Greenland, has recently expounded his views respecting an expedition to the North Pole before the Geographical Society of Norway, at Christiana. Dr. Nansen stated that he believed De Long was quite correct in his idea of endeavoring to penetrate to the pole by means of the warm current that flows up Behring Strait. Three years after De Long's expedition articles belonging to the Jeannette were picked up on the west coast of Greenland. These must have drifted across by Spitzbergen, down the coast of Greenland and up the west. A piece of wood, identical in kind with that used by the natives of Alaska to make their bows, had been found on the coast of Greenland. The Esquimaux of Greenland fish up drift timber belonging to the Siberian larch, and to the red and white pines of the west coast of North America. He believed that the warm current flowed up Behring Strait, past the New Siberian Isles, across the pole, between the pole and Franz Josef's Land, and then between Spitzbergen and Greenland. The thing needed to reach the pole was to have a vessel built extraordinarily strong, and with sloping sides, so that she could not be crushed in the ice, but would be simply lifted upward by it. In such a vessel he proposed to go through Behring's Strait, then to the New Siberian Islands, and then to plow onward northward through the ice, going with the current, packed up safe, not caring for being frozen up. With few men and good, and plenty of provisions, such a course did not offer extraordinary risks. Even should the vessel be crushed, many experiences have shown that a crew can safely take to the ice. Dr. Nansen then dwelt on the scientific results, geographical, meteorological, etc., that would flow from the successful accomplishment of such a journey.

Australasia and Polynesia.—According to a convention between England and Germany, the latter power not only has possession of the northern half of the eastern part of New Guinea, but has the right to

extend its rule over all unclaimed islands in the Eastern Pacific. This gives Germany the Admiralty Isles, New Hanover, New Ireland, New Britain, the Solomon Archipelago, the Gilbert or Kingsmill Islands, the Ellice and the Phœnix groups, also the Samoan and Tongan. Complications, as is well known, have already arisen over the Samoan Island, and, as the German fleet in Pacific waters is by no means sufficient to enforce the proper treatment of white men by the natives of all these scattered groups, trouble may be expected in other quarters. No power but Germany has a right to interfere to enforce order in any of these islands, except as circumstances may compel modifications.

The Carolines.—A recently published work upon the Caroline Islands gives the results of the studies of J. S. Kubary in the Caroline group, which he first visted in 1868, as agent for the Godeffroy Museum at Hamburg. The group lies between five and ten degrees of north latitude, and stretches from 130 to 160 of east longitude. The population is rapidly diminishing, largely on account of the hiring of native labor by the whites. The current cash of these islands is for the most part formed of shells, and the natives are very particular in limiting each kind to its special purpose. Thus in Yap equal-sized disks made out the shells of the Spondylus, and polished, form a money not in use among the general public, but accumulated by the chiefs to purchase canoes or weapons to resist or attack. The Spondylus is only found in the east and north of the island of Yap, is used on this and some other isles, and is traditionally the oldest form of money—it occurs in old graves of the Ladrone chiefs. The next most valuable money consists of disks of arragonite, obtained from the Pelew Islands. These are called *palan*, and are known as "men's money." A third variety, formed of small threaded nacreous shells, is called *yar*, and known as "women's money."

In the Pelew Islands beads, called *andouth*, and probably obtained by trading, form the currency. Each variety of bead has a different value, and payments are made in specifically prescribed forms. Thus forty to fifty beads that are in the hands of one or two of the kings have a value representing £10 to £12 each. If a debtor does not possess the correct money in which to make payment, he has to borrow the right kind. Herr Kubary believes that this system must have been acquired from the Malayan States. There is a strong diversity between the textile arts, the methods of tattooing, the stature, the appearance, and the general physical characters of the natives of contiguous islands in this group.

New Guinea.—The proceedings of the Royal Geographical Society for April of this year contain Sir W. Macgregor's account of his expedition to the culminating point of the Owen Stanley range of New Guinea. On a trip to Doura, a district northwest of Port Moresby, he was told of a river named Vanapa. On April 20 he found an opening hidden in a bend of the inlet, and held his way up the river until the 27th, when the rapids became very strong, and the party were compelled to take the shore. Somewhere about this point was found a most ingenious native bridge of V-shape, at a spot where the stream was 70 yards in width. The structure was supported by a banyan-tree at one end, and by a small tree and a post at the other. The bottom was composed of four rattans, above which, at a height of about two feet six inches were two rattans on each side, and two feet three inches above these were three on one side and four on the other. The rattans were kept in position by split canes worked in. The distance between the upper rattans was about three and a half feet. Platform approaches were made at both ends.

The advantages offered by the Venapa as a basis from which to ascend the Owen Stanley range were evident, and Sir W. Macgregor resolved to avail himself of them. Considerable trouble was, however, experienced with the native porters, who objected to ascend the heights. These difficulties were at last surmounted, and the Governor, with one or two companions, eventually succeeded in following the main ridge to its culminating eastern extremity, now known as Mount Victoria. The difficulty of obtaining provisions was great, and the woods swarmed with the scrub-itch insect and with ticks, while in ground soaked with rain and warmed in the sun great numbers of leeches were encountered, of two kinds, one thin and wire-like, three-quarters of an inch in length, the other as thick as a goose-quill, and about two inches long. The mountains were found to be of slate, intersected with quartz veins. The summit called Mount Knutsford, 11,100 feet high, was reached on June 6th, and this point proved to be the best from which to follow with the eye the course of the Vanapa, which drains the entire south side of the Owen Stanley range from Mount Victoria to Mount Lilley. After a descent, the next summit, Winter Height, was ascended (11,882), then Dickson Pass (10,844) was crossed, and the highest peak (13,127–13,205 feet) was climbed. Alpine plants were not met with until within about 570 feet of the summit.

Africa.—Dr. Meyer's Ascent of Kilima-njaro.—Dr. Meyer has recently made a second and entirely successful attempt to climb the great ice-dome of Kibo, the main summit of Kilima-njaro. The principal reasons for the failure of the former attempt were the difficulties of procuring provisions sufficient for the continued stay needed, and the want of ice-axes and rope to aid in surmounting the steep wall of ice met with near the summit. To remedy the former, Dr. Meyer made friends with the young chief Mareale, of Marangu, with whom he established a camp of substantial huts for the shelter of his caravan; a second camp was formed at a height of 9,515 feet, where eight porters were left. A tent was pitched upon the saddle connecting the peaks of Mawenzi with Kibo, at a height of 14,270 feet. Each day three or four men brought provisions from Marangu to the middle camp, and two men climbed to the upper camp, so as to keep the travelers supplied. In order to conquer the ice-slope, Dr. Meyer had secured the services of Herr Purtsheller, an experienced Alpine mountaineer, provided with ice-axes and other essentials. These two spent in all sixteen days among the higher peaks, while a faithful negro stayed all the while at the upper tent. On the first occasion they left the upper camp at 2.40 A.M., and by breakfast time had left the peaks of Mawenzi below them. There was less snow (October) than had been found on the previous ascent (July, 1887). At 15,980 feet a lava dyke, with evidences of glacial action, was encountered, and the first patches of snow were found at 16,400 feet. At 17,650 feet the travelers reached the ice-slope, with an angle of 35°, conquered it in two hours, and in another hour and a quarter reached the summit-ridge, and found themselves upon the edge of an immense circular crater. The point where they stood was not the highest portion of the jagged rim, and it was not until three days later, after a return to their tent, that the travelers, using their former steps and sheltering themselves for a night in a cave, the temperature of the interior of which was 12° C., succeeded in reaching what Dr. Meyer proudly states is "probably the highest point of the German possessions." This point is estimated (by aneroid only) at 6,000 metres, or 19,684 feet. The diameter of the crater is at least 2,200 yards, and the depth of the floor 650 feet. Upon the north and east the ice descends in terraces to the bottom, but on the west and south steep lava cliffs break out of the ice-cap. In the centre a cone of brown ashes, with the top bare, rises to a height of 500 feet. The girdle of ice and snow wreathed around this cone sweeps out over a gap in the western wall of the crater-rim in the form of a glacier about a mile and a half long

(including the part within the crater), which terminates at the height of 17,900 feet. A great portion of the crater is filled with névé, assuming the form called in the Andes *nieve penitente*, from the fancied resemblance of the hardened masses left standing above the general level to the figures of kneeling penitents. The highest trace of humanity found upon the mountain was a hunter's bivouac at 15,400 feet.

Dr. Meyer made three attempts at the Mawenzi peaks, reaching a height of 16,260 feet, though he did not attain the highest pinnacle. The broken and fantastic peaks of this group surpass description in their rugged magnificence, and are evidently the skeletal remains of a volcanic crater far older than that of Kibo. On the eastern flank one looks from a precipice of 6,500 feet to the country below. Our traveler believes that the former crest of Mawenzi stood southeast of the present highest point, and that its original height approximated that of Kibo. Numerous flowers and grasses ascend the sheltered slopes of Mawenzi to a height of 15,750 feet, and elk and antelope from the northern side come over the saddle to browse upon them. The slopes on the southern and eastern side from 6,500 to 9,750 feet are covered with primeval forest, which is continued as a narrow interrupted belt on the north side of Mawenzi, but vanishes altogether on that of Kibo. Below the forest, upon the southern slope of the entire mountain, extends the fertile and well-watered plain of Ohagga; while to the north are waterless, regularly sloping plains, with grass and wild brush, inhabited by the Masai.

The mountain land of Uguene, to which Dr. Meyer took a ten days' trip after his ascent, is a gneiss range to the west of Lake Jipe. The inhabitants are known as Waguene. South of Uguene lies Usangi.

Before leaving the neighborhood, Dr. Meyer made an excursion to Madjame, previously visited by Van der Decken. On his way he traversed the districts of Uru, Kindi, Kombe, and Maruma, and crossed two large rivers, one of them the Weri-Weri, which takes its origin from the foot of the glacier that escapes from the crater of Kibo. The Ngorube draws off all the water from the melting ice of the south side of the mountain, and flows to Pangani. Dr. Meyer falls into raptures about the magnificent aspect of the mountain from Madjame, with the typical volcanic curve exhibited by its 6,000 feet of ice-cap, and with the grand ravine of the Weri-Weri leading upward to the glacier.

A map or plan and a bird's-eye view of the crater of Kibo accompany Dr. Meyer's account of his ascent in *Petermann's Mitteilungen*, 1890, Pt. I. The cone of ashes occupies a northern position in the depression, while the glacier and beds of névé fill in the southern part. The rim to the northward is swathed in ice, but the highest ice-covered peak is inferior in elevation to "Kaiser Wilhelm Spitze," on the south side, where the peaks are free from ice.

Lake Leopold.—The April issue of the Proc. Roy. Geog. Soc. contains an account of H. H. Johnston's journey to Lake Leopold, Rukwa, or Rukuga, north of Lake Nyassa. This lake is but the shrunken vestige of a much greater body of water, yet it extends much farther to the southeast, and is longer than was supposed. On its southern and western sides a level plain extends to a width of from twenty-five to thirty miles, but on the east side the mountains rise direct from the shore. The basin is girdled with mountains, and on the southeast there is a remarkable bay or inlet of the lake penetrating into them. The only affluent of the lake from the south is the Sengive, which rises near the more important Songeve, a tributary of Nyassa. On the west shore, about the middle of its length, enters the Saisi, a large river with many affluents. The lake, which swarms with hippopotami, crocodiles, and fish, is at a level of 2,900 feet above the sea. Notwithstanding the unlovely character of its shores, they are frequented by elephants, buffalo, zebra, many species of antelopes, guinea-fowl, francolins, ring-doves, etc. Nothing can be grown, and the natives live entirely by rapine or by the chase. Mr. Johnston was the first white to visit the region, and he came among them suddenly with 150 followers without asking permission.

In 1889 Dr. Abbott and T. Stevens found a stream coming from the east side of Kilima-njaro, and running into the Tsave river. They followed it upwards into a cañon, and farther still until its course was covered over by a lava-stream. They discovered a nest of small extinct craters, and among them one that held a lovely lake, bordered with palms, and containing abundance of fish, at 100 feet below its rim. Probably this is a pool in the course of the subterranean river, which is marked higher up by a streak of black lava. The lake is 3,000 feet above sea level. These travelers speak a good word for the much abused Masai, call them jolly good fellows, and deny some of the strange customs usually attributed to them.

GEOLOGY AND PALEONTOLOGY.

The Origin of Petroleum and Gas. — The following statements bring before us the principal views as to the origin of petroleum, viz :

1. Petroleum is produced by the primary decomposition of organic matter, and mainly in the rocks that contained the organic matter. Of this view, Hunt is one of the chief advocates.

2. Petroleum results from the distillation of organic hydrocarbons contained in the rocks, and has generally been transferred to strata higher than those in which it was formed. Newberry and Peckham have been quoted at length in support of this general theory. Newberry holds that a slow and constant distillation is in progress at low temperatures. Peckham refers the distillation of the petroleum of the great American fields to the heat connected with the elevation and metamorphism of the Appalachian mountain system.

These views as to the date of the origin of petroleum and gas are seen to cover almost all the possibilities in regard to the subject. Hunt believes petroleum to have been reduced at the time that the rocks that contain it were formed, once for all. Newberry believes it to have been in process of formation, slowly and constantly, since the strata were deposited. Peckham refers it to a definite and distant time in the past, but long subsequent to the formation of the petroliferous strata. He supposes it to have been stored in its subterranean reservoirs from that time to the present.

In these several statements as to origin, two questions are seen to be especially prominent, viz: What particular kinds or classes of rocks are the sources of petroleum? and, What is the value of the chemical processes involved in its production?

In answering the first question, we find the views of Hunt and Newberry distinctly opposed to each other. Hunt counts limestones the principal source of petroleum, and denies that it has been produced by distillation from bituminous shales; while Newberry finds in these shales the main source of both oil and gas, and vigorously opposes the view that limestones are ever an important source of either.[1]

It is not necessary to follow the discussion in relation to these points further. It is enough to say that in the light of present knowledge each statement is sustained as to its particular affirmations and inconclusive as to its general denials. Petroleum is undoubtedly indigen-

[1] Rept. Geol. Survey Ohio, Vol. I., p. 159.

ous to and derived from certain limestones, as Hunt has so strongly asserted. On the other hand, Newberry's doctrine that the great supplies of the Pennsylvania field are derived from Devonian shales is becoming more firmly established and widely accepted every year, though it seems likely that he has laid too much stress on bituminous shales. In other words, the theories are not incompatible with each other. Different fields have different sources. We can accept without inconsistency the adventitious origin of the oil in Pennsylvania sandstones, and its indigenous origin in the shales of California or in the limestones of Canada, Kentucky, or Ohio.

The double origin of petroleum from both limestones and shales—and it is not necessary to exclude sandstones from the list of possible sources—deserves to be universally accepted. In confirmation of this double origin, it is coming to be recognized that the gas and oil derived from them two sources—limestones and shales—generally differ from each other in noticeable respects. The oil and gas derived from limestones contain larger proportions of sulphur and nitrogen than are found in the oil and gas of the shales. Nitrogen renders the oils unstable, and sulphur compounds impart to them a rank and persistent odor from which they can be freed only with great difficulty. In the case of the oil-bearing shales of California, the petroleum is evidently derived from the animal remains with which the formation was originally filled. In composition this oil agrees with the limestone oils already described. It contains more than four times as much nitrogen as the Mecca oil of northeastern Ohio, and its percentage of sulphur is very high. Peckham says of the Pennsylvania oils:[2]

"The exceedingly unstable character of these petroleums, considered in connection with the amount of nitrogen that they contain and the vast accummulations of animal remains in the strata from which they issue, together with the fact that the fresh oils soon become filled with the larvæ of insects to such an extent that pools of petroleum become pools of maggots, all lend support to the theory that the oils are of animal origin."

He speaks again of this class of petroleums as formed of animal matter that has not been subjected to destructive distillation.[3]

It now appears as if oil and gas derived from animal remains can be distinguished from those of the bituminous shales by the characters above described. Certain it is that the "limestone oils" differ in physical characteristics from the Pennsylvania oils, for example, in a

[2] Op. Cit., p. 69.

[3] Ibid., p. 71.

marked degree. They are dark in color; they are heavy oils, their gravity generally ranging from 34° to 36° Beaumé, though sometimes falling to 40° or even 42°; they have a rank odor, arising from the sulphurous compounds which they contain. The oils of Canada, Kentucky, Tennessee, and of the fields in northwestern Ohio all agree in these respects, and the oil and gas of the Utica shale and Hudson River group of the state fall into the same category.

In the preceding statements the organic matter of the bituminous shales has not been positively referred to a vegetable source. Such a source is highly probable, but it cannot be said to be fully demonstrated until the origin of the so-called *Sporangites* of the shales is finally determined. There are a few geologists who are inclined to refer these forms to hydroid zoophytes (animal) rather than, with Dawson, to marine rhizocarps (vegetable). Whatever their origin, they give rise to petroleum and oil of a definite character, which is in marked contrast to that of the limestone oils.

Which of these theories as to the mode and time of origin of petroleum has the most to commend it?

In conclusion, a few of the previously stated propositions in regard to the origin of petroleum that seem best supported will be concisely summarized:

1. Petroleum is derived from organic matter.

2. It is much more largely derived from vegetable than from animal substances.

3. Petroleum of the Pennsylvania type is derived from the organic matter of bituminous shales, and is of vegetable origin.

4. Petroleum of the Canada and Lima type is derived from limestones, and is of animal origin.

5. Petroleum has been produced at normal rock temperatures (in Ohio fields), and is not a product of destructive distillation of bituminous shales.

6. The stock of petroleum in the rocks is already practically complete.—*Edward Orton in Ann. Report U. S. Geol. Survey, 1886–'87. (Published 1890).*

Production of Salt in the United States.—In 1887 the production of salt in the United States was 7,831,962 barrels of 280 pounds each. Of this, the value was estimated at $4,093,846. Michigan produced 3,944,309 barrels; New York, 2,353,560 barrels; Ohio and West Virginia, about 600,000; Kentucky, Tennessee, and Virginia, about 200,000; or about 7,000,000 barrels in all produced from the evaporation of brines. In addition, Louisiana produced 225,000 bar-

rels from the quarries of rock salt at New Iberia; Utah, 325,000 barrels, mostly from the waters of Salt Lake, but a small portion from the quarries of rock salt in Jaub and Sevier counties. California produced in former years over 200,000 barrels, chiefly from the evaporation of sea-water in San Francisco Bay, but in 1887 the production was only 28,000 barrels, in consequence of a combination of the operators to reduce the output and enhance the price.

In Kansas a discovery of rock salt has recently been made, which promises to be an important addition to the resources of the State. The salt beds lie near the base of the Trias, and occupy a large area in the southern portion of the State, extending into Texas. In seven localities cited by Mr. Robert Hay, in the biennial report of the Kansas State Board of Agriculture, the rock salt lies at depths varying from 450 to 925 feet, and the thickness is from 75 to 250 feet. The production in 1888 was about 2,000 barrels.

In New York the production of salt is about equally divided between the reservation at and about Syracuse and the Warsaw district in Western New York, the latter having increased with great rapidity. The salt from the Onondaga Reservation is obtained from the evaporation of the brine of about 40 wells; these wells have an average depth of 330 feet, and the strength of the brine is about 70 per cent. of the salometer.

In the Warsaw district there are about 50 wells in operation, from 800 to 2,500 feet in depth. According to the report of Dr. F. E. Englehart the entire production in 1887 was 6,072,000 bushels.

The well at Piffard, belonging to the New York Salt Company, is producing rock salt, and is the pioneer enterprise of this kind in the State. The first bed of salt was reached at a depth of 938 feet. This bed is two feet in thickness, and is separated from the second bed, 12 feet in thickness, by 4 feet of shale. The third salt bed was 6 feet thick and 28 feet below the second; and the fourth bed, 9 feet below the third, was 58 feet in thickness.—*J. S. Newberry, in Transactions of the N. Y. Academy of Sciences, Nov., 1889.*

Geological News.—General.—O. Feistmantel, in his account of the geology of South Africa, parallels the Karroo formation with the Gondwana of Hindustan. The upper beds of this formation he considers equivalent to the Mesozoic coal-measures of Eastern Australia, the middle Karroo to the Hawksbury beds, and the lower Karroo to the upper coal-beds and upper marine beds, which last are probably representative of the Permian and Carboniferous of general geology, so that the upper and middle Karroo may represent respec-

tively the Lias and the Trias. The cape formation is paralleled with the Vindhya of Hindustan, which probably represents the lower Carboniferous and Devonian. The South African primary includes metamorphic and archaic.

The Imperial Geological Survey of Japan has publised a reconnaissance map, scale 1–400,000; sectional maps, scale 1–200,000; and agronomic maps of twice the latter scale. The reconnaissance sheets comprise North Japan between 138° E. and 38° N., and N. Japan from 38° to 40° N., while the sectional maps include the provinces of Shikoaka, Fuji, Kofu, Veda, Nagano, Izu, Yokohama, Tokio, Mayebashi, Nikko, Kakusa, Chiba and Mito. T. Harada, writing of the geotectonic "membering" of Japan, states that the outer oceanic curve of the islands, though poor in volcanoes, is rich in seismic activity, while the inner side is rich in recent eruptive masses, active volcanoes and thermal springs. The Japanese Sea is a great "Kesselbruch" (chaldron-fissure), and the archipelago is its eastern border.

Palæozoic—The *Geological Magazine* for March, April, and May of this year contains notes on the palæontology of Western Australia. A. H. Foord describes the gastropods, brachiopods, etc., including the new species of Spirifera, while G. J. Hinde gives the corals and polyzoa, with a new genus of the former.

In a recent number of the *Quar. Jour. Geol. Soc.* T. Rupert Jones describes many new species of palæozoic Ostracoda from North America, Wales, and Ireland.

G. J. Hinde describes (*Quar. Jour. Geol. Soc.*, Feb. 1, 1890) a new genus of siliceous sponges from the lower calcareous grit of Yorkshire, and names it Rhaxella. Small globules of silica take the place of elongated spicules in this sponge.

Mesozoic.—In the Wealden near Hastings Mr. R. Lydekker identifies five distinct species of Iguanodon, viz: *I. bernissartensis* Dollo, *I. mantelli*, *I. dawsoni* Lyd., *I. fittoni* Lyd., and *I. hollingtoniensis* Lyd. He also maintains the existence in the English Wealden of two species of Megalosaurus, one of which is *M. dunkeri*, while the other is yet undescribed.

Comoliosaurus (*Pliosaurus*) *portlandicus* has been proved to range upwards to the middle Purbeck.

G. Cotteau has commenced the study of the cretaceous echini of Mexico on six species collected by S. R. Castillo, the director of the

mines. Three of these forms, *Pseudocidaris saussurei* Loriol, *Holectypus castilloi* Cotteau, and *Heteraster mexicanus*, are peculiar to Mexico, but the three others have previously been found outside of that country. *Diplopodia malbosi* is common enough in France in the aptian, as is also *Salenia prestnesis* Desor. *Laniera lumen*, from the higher cretaceous beds, is sufficiently common in Cuba.

According to M. A. de Grossenore, the callovian beds east and west of the primitive mass of La Vendee have some fossils, unlike those of the Paris basin, but like those of the callovian of the Alps and Carpathians. *Terebratula antiplecta* occurs here, and is also found in the Tyrol and in Galicia. There also occur Terebratulæ of the groups *nucleata* and *bivallata*, and *Rhynchonella acutiloba*. The callovian of Cape Mondago (Portugal) is analogous.

Tertiary.—The discovery of a new mandible of Dryopithecus has recently led M. A. Gaudry to compare it with the lower jaw of man and of the existing apes, with the result that it proves to be inferior in type, not only to the former, but to most of the latter. The lengthened jaw and the contracted space left for the tongue are the two points chiefly dwelt upon. In these respects the gorilla is below the orang, which again is inferior to the chimpanzee. M. A. Milne-Edwards stated that the Dryopithecus was nearer to the gorilla than to any other existing ape, and that the prognathism of the jaw was so excessive that one might suppose the animal to have been quadrupedal.

A giant example of a fossil tortoise, with a carapace five feet and a half in length and rather more than three feet nine inches wide, has been discovered by M. Deperet in the red clays of the upper Miocene of Mont Leberon. Portions of this species had been previously found by M. A. Gaudry, but the present specimen was in astonishingly complete preservation, the body standing nearly in a natural position in the side of a ravine. The carapace was somewhat crushed with the superincumbent weight. This tortoise is larger than any other known living or fossil form except *T. atlas* of the Himalayas. It is, however, so very near in all important characters to *Testudo perpiniana*, which occurs in the environs of Paris, and has been found with a length of four feet, that it may probably be best regarded as a variety of that species. Though *T. perpiniana* is of Pliocene age, and the new fossil was found in the uppermost beds of the Miocene, the resemblance is great.

In a recent issue of the *Quarterly Journal* of the Geological Society of London, Mr. R. Lydekker treats of the presence of the Striped Hyæna in the Pliocene beds of the Val d'Arno, describing the remains in answer to the assertion that they belonged to *H. crocuta.* It is curious that these two species do not now exist in the same localities, though in ancient times they seem to have done so; also that they have to a considerable extent interchanged their localities.

Recent.—Capt. A. W. Stiffe recently read a paper before the Geological Society of London concerning the glaciation of the Sind and Jhelam valleys in the Himalayan mountains of Kashmir. He stated his belief in the gigantic character of the ancient glaciation and gave a general description of the features of the Sind valley and of the existing glaciers near Sonawarg. At this point there are snow fields at a lower level than the foot of the glacier, which is rather unusual. Very perfect typical older terminal moraines exist at Sonawarg, some of them four miles below the present termination of the glaciers, and at an elevation of 10,000 feet. These once blocked up the Sind River, and the sections cut by the rivers through these moraines are remarkable. The glaciated appearance of the gorge below Sonawarg is very striking, and the entire Sind valley presents a continual succession of moraines. The hillsides of the valley exhibit a comparatively rounded outline to a height of 2000 feet or more, while above this they are rugged.

The existing lakes of the Kashmir district were referred by the writer to glacial action—they were the remains of a former much more extensive alluvial lake which had been largely silted up; he then treated of the supposed glacial deposits of the Jhelam valley, and stated that the whole valley from Baramilla to Mozufferabad contained extensive glacial or moraine deposits. In conclusion attention was drawn to the great deposits of travelled granite blocks at Rampoor, blocks which from their size, and from their difference from the neighboring rocks, must certainly have been carried thither by the action of glaciers.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—A contribution to the knowledge of the geology of South America has recently been made by Bergt[2] through the study of thin sections of rocks collected in the Sierra Nevada and the Sierra de Peryá in the United States of Columbia. Bergt has confined himself to a description of a large number of rocks that were collected by others, and therefore he has not been able to do more than indicate the interesting results which follow from a close study of their thin sections. Among the facts of general interest discovered may be mentioned the formation of secondary epidote from augite and olivine in melaphyre, and the production of an epidosite therefrom; the occurrence of lamellæ in uralite of syenite, that have became curved through the pressure exerted upon them by a feldspar crystal during its growth; the existence of a rim of brown hornblende around a grain of uralite, and the occurrence of secondary brown mica as a product of the alteration of augite. The writer also discusses the nature of uralite, and suggests that the name uralitite be used as a comprehensive one for those rocks containing secondary hornblende, whose original nature cannot be determined.——Goller[3] describes in a very careful article a number of lamprophyre dykes cutting gneiss and crystalline schists in the Vorspessart in Germany. The crystalline schists consist of dioritic and "augen" gneisses, produced by pressure from eruptive rocks, and other gneisses, the history of whose origin is unknown. They are cut by dykes of camptonite and kersantite, whose characteristics are minutely described by the author. Both contain large quartz and orthoclase grains that are supposed to be the remnants of dissolved inclusions, and smaller quartzes that have crystallized from the magma. Two varieties of augite were observed; one alters into talc and tremolite through green hornblende, and the other into serpentine through the same intermediate product. The original quartz is supposed to owe its origin to the physical conditions prevailing during the solidification of the rock mass—principally pressure and the presence of water.——Still other instances of the occurrence of young rocks with the characteristics of old ones are described by Reiser[4] from four localities in the northern Alps. They are typical diabases and diabase porphyrites of Eocene age. They con-

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] *Min. u. Petrog Mitth.*, 1889, X., p. 271.
[3] *Neues. Jahrb. f. Min.*, etc., B. B. VI., p. 485.
[4] *Min. u. Petrog. Mitth.*, X., 1889 p. 500.

sist of plagioclase, augite, apatite and secondary substances, and occur with the typical structure of granular and aphanitic diabases. They are characterized by the zeolitization of the plagioclase. Among the zeolites formed are natrolite and analcite, of which the latter has been separated and identified by chemical means.——Thin veins of diabase with tachylite borders have produced fusion along the edges of the slates through which they cut. According to Rutley[5] the glassy rim produced by the fusion is darker in color than the tachylite selvages of the dyke rock.——N. H. and H. V. Winchell[6] propose a new theory for the origin of the iron ores of Minnesota, in opposition to the iron carbonate theory[7] of Irving. The new theory follows the same lines as does Hunt's crenitic hypothesis. It is based entirely on theoretical suppositions, which, so far as is known, can have little foundation in facts.

Mineralogical News.—*Rare Minerals.*—In an article on the minerals of Fiskernäs, in Greenland, Ussing[8] has given the crystallographic and optical properties of several rare minerals. *Sapphirine* has for its axial ratio $a : b : c = .65 : 1 : .93$. $\beta = 79° 30'$. The axis of least elasticity is inclined 8° 30′ to the vertical axis, and $2V_{na} = 68° 49'$. The indices of refraction are $\alpha = 1.7055$, $\beta = 1.7088$, $\gamma = 1.7112$. The mineral is negative, and is pleochroic with A colorless, and B and C = blue, or A = light greenish blue, B = dark bluish green, and C = yellowish sap green. An analysis of the mineral yielded:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	Loss
12.83	65.29	.93	.65	19.78	.31

Kornerupine is orthorhombic with $a : b = .854 : 1$. It has a specific gravity of 3.273, is colorless in thin section, and has $\infty \bar{P}\infty$ as the plane of its optical axes, with c the acute bisectrix, which is negative. The optical properties of *gedrite* and *pargasite* are also investigated. In a few general remarks on the properties of the former mineral the author states that it is more probable that the optical angle of the orthorhombic hornblendes increases with the increase in the percentage of silica rather than with the increase of iron.——*Atelesite*, analyzed by Busz,[9] yielded:

As_2O_5	Bi_2O_3	Fe_2O_3	H_2O
14.12	82.41	.51	1.92

[5] *Quart. Jour. Geol. Soc.*, 1889, p. 626.
[6] *American Geologist*, Nov. 1889, p. 291.
[7] AMERICAN NATURALIST, Dec., 1886, p. 1050.
[8] *Zeits. f. Kryst.*, 1889, XV., p. 596.
[9] *Zeits. f. Kryst.*, 1889, XV., p. 625.

The axial ratio, recalculated from von Rath's measurement, is $a : b : c = .9297 : 1 : 1.5123$. $\beta = 69° 35'$. New measurements by Busz gave $a : b : c = .9334 : 1 : 1.5051$. $\beta = 70° 43'$.——*Kobellite*, from the Silver Bell Mine, Ouray, Colorado, has been analyzed by Kellar.[10] Its composition is:

S	Bi	Sb	Pb	Ag	Cu	Fe	Zn	Gangue
18.39	28.40	7.55	36.16	3.31	2.59	1.50	.39	.45,

which may be represented by $2(Pb.Ag_2Cu_2)\ S.(BiSb)_2S_3$. It differs in composition from the mineral called kobellite by Rammelsberg (Pb_3BiSb_6), but is like that to which the name was first given by Selterberg. The same author suggests the name *lillianite* for a substance of the composition $3(PbAg_2)\ Bi_2S_3$ described by himself[11] several years ago.——*Nivenite* is a rare mineral associated with fergusonite and gummite at the gadolinite locality in Llano County, Texas. It is described by Genth[12] as velvety black, with a brownish streak. It is easily soluble in nitric acid, and possesses the composition:

UO_3	UO	ThO_2	Y_2O_3, etc.	Fe_2O_3	PbO	Ign	Ins	Sp Gr
46.75	19.89	7.57	11.22	.58	10.16	2.54	1.22	8.01

It is allied to bröggerite ($3RO.UO_3$) and clevéite ($6RO.2UO_3.3H_2O$) in containing a large proportion of uranium. Its hardness is 5.5, and its composition is represented by ($9RO.4UO_3.3H_2O$). Two varieties of *fergusonite* have been found in the same locality. The first corresponds to $Cb_2O_5.R_2O_3.H_2O$, and the second to $Cb_2O_5.R_2O_3.3H_2O$. The two are closely associated. The first is probably tetragonal, with a bronzy lustre on a fresh fracture. It is infusible, decrepitates when heated, and changes to an olive green color. The second variety is deep brown in color. Its streak is greenish gray. Upon ignition it turns light brown but does not decrepitate.——*Hydrocerussite* ($2PbO_3 + Pb(OH_2)$, corresponding to azurite among the copper salts, has been produced by Bourgeois,[13] by acting upon lead acetate with ammonium carbonate. The little crystals thus formed have all the properties of the natural substance. By means of them the composition of the mineral has been determined. The white lead of commerce is found by the author to be a mixture of two substances with the composition respectively of cerussite and hydrocerussite.——*Percylite* and *caracolite* are briefly mentioned by Fletcher[14]

[10] *Zeits. f. Kryst.*, 1889, XVII., p. 67.
[11] *Jour. Amer. Chem. Soc.*, Vol. VII., No. 7.
[12] *Amer. Jour. Sci.*, Dec. 1889, p. 474.
[13] *Bull. Soc. Franc. d. Min.*, XI., p. 221.
[14] *Min. Magazine*, 1889, p. 171.

as among the many lead salts produced by the decomposition of bournonite and galena at the Mina Beatriz, Sierra Gorda, Chili.

Miscellaneous.—Pseudomorphs of talc after quartz, magnesite and calamine are found not uncommonly in a talc layer at Göpfersgrün, near Wunsiedel in the Fichtelgebirge, near a contact of granite and limestone, that has suffered dolomitization as the result of the action of magnesian solutions emanating from the eruptive rock. The genesis and growth of the talc pseudomorph after quartz are carefully described by Weinschenck [15] as taking place in the following manner. The quartz crystals are first traversed by numerous capillary cracks, running parallel to the prismatic faces and rarely parallel to the rhombohedral planes. Along the sides of these, little plates of talc are developed. From certain points within the crystal other fissures then begin to form, and along the sides of these more talc is formed, until finally there remain only a few isolated areas in which the original mineral can be detected. The production of the new mineral along the cracks leads to the supposition that the change is due entirely to the medium of circulating water, a view that is substantiated by experimental researches.——An important contribution to the discussion of optical anomalies has been made by Erb [16] in a study of sodium acetates of copper, magnesium, nickel, and other metals. When allowed to crystallize slowly these salts form at first uniaxial crystals belonging to the hexagonal system. As they increase in size the crystals become twinned according to certain orthorhombic laws. In thin section they show twinning lamellæ, which disappear when the temperature is raised to 65°. The etched figures produced in both the simple and twinned crystals are of the same shape. They lie in the same relative positions, and are not symmetrically developed about the twinning planes of the lamellæ, but they have the symmetry belonging to the hexagonal system. The twinned crystals are pyroelectric, but upon assuming the isotropic condition they lose this property entirely. To account for these anomalies the author thinks that a strain has been superinduced in them during their growth. If they are mimetitic forms it is odd that the crystals should possess a certain grade of symmetry when small, and assume it again when heated.——Upon treating freshly precipitated ferric hydroxide at 250° with water, to which a trace of ammonium fluoride has been added, Bruhns [17] obtained little plates of *hematite* with hexagonal cross sections. Freshly precipitated alumina

[15] *Zeits. f. Kryst.*, XIV., p. 305.
[16] *Neues Jahrb. f. Min.* etc., B. B. VI., p. 121.
[17] *Neues. Jahrb. f. Min., etc.*, 1889, II., p. 62.

when treated in the same way at 300°, yielded little crystals of *corundum* with pyramidal terminations. *Quartz* crystals with rhombohedral terminations were produced by heating pulverized glass or amorphous silica to 300° under the same conditions. Microcline gave *tridymite* plates. A mixture of metallic iron, iron oxide and amorphous silica produced litte black amorphous plates of *ilmenite* and crystals of *magnetite*. The syntheses are of importance as indicating the possibility of the formation of contact minerals at a low temperature in the presence of traces of fluorine.——Johnston [18] has subjected muscovite and biotite to the action of pure water and to that of dilute carbonic acid for the length of one year. The *muscovite* undergoes no change in this time except slight hydration, in consequence of which it becomes a hydro-muscovite resembling margarodite in composition. Biotite during this time becomes bleached under the influence of the carbonic acid. It loses some of its magnesium and iron, assumes water, and passes like the muscovite into a hydromuscovite. Anhydrous micas when they undergo hydration increase in bulk, a fact that may help to explain the cause of the rapid weathening of micaceous sandstones.——Bruhns [19] has succeeded in obtaining genuine *glass inclusions* in quartz by heating in a bath of molten granite specimens of phrase and pieces of quartz containing inclusions of fibrolite. The resulting glass is entirely surrounded by quartz, and is not merely a portion of the granitic substance filling cracks produced in the mineral by heating. The inclusions are arranged in straight and curved lines, and have all the properties of inclusions found in porphyritic quartzes.——A brief comparison of the shapes of the etched figures in diopside and spodumene is made by Greim [20]. The depressions found on the ∞ P faces of the first mineral are nearly triangular, with their apices inclined toward the positive hemi-pyramid.——Mr. Lane [21] describes a method of determining the values of the optical angles of minerals in thin sections of rocks without the use of converged light.

[18] *Quart. Jour. Geol. Soc.*, May, 1889, p. 363.

[19] *Neues. Jahrb. f. Min., etc.*, 1889, I., p. 268.

[20] *Miner. Magazine*, May, 1889, p. 252.

[21] *Amer. Jour. Sci.*, Jan., 1890, p. 53.

BOTANY.

Some Elementary Botanies.—That there is a dissatisfaction with the commoner methods of teaching botany as set forth in the text books, is indicated by the numerous attempts of various teachers to give us better books. In no other science is there to-day such diversity of opinion as to the best method of introducing the pupil to the subject to be studied. As a result we have a multiplication of elementary books, each designed to lead the pupil into his work by a different route. For twenty years the little books by Miss Youmans have stood as a sort of protest against mere "book botany." Though faulty in many particulars, they were valuable in showing that there are other ways of teaching botany than the stereotyped ones. A recent book, "Descriptive Botany," by the same author, has much in it to commend. At the very beginning the pupil is told to supply himself with his own material for examination. He is told to "gather a variety of leaves; and to begin their study by comparing them," etc., etc. Further on we find this: "Pull up any herb which has a distinct stem, and compare the stem with the root," and so on repeatedly. This is excellent, and the pupil cannot fail to be greatly benefited by such a course. There is too marked an emphasis given to technical terms, which are needlessly printed in italics, and too frequently there is a dictionary-like brevity, as when we read that "The leaf of a fern is called a *frond*," and "The stalk or petiole of a frond is called a *stipe*." Why this is so is not hinted. The "Popular Flora" is just what it pretends to be—popular—and will be useful to the beginner who has prepared himself aright to take it up. It contains brief but plain descriptions of the more common flowering plants including cultivated as well as wild species. It is pleasant to note that the Gymnosperms are assigned to their proper place between Angiosperms and the Pteridophytes. It is not so pleasant, however, to note that the explanation of the structure of the flowers of the Conifers (the sole representatives of the Gymnosperms) is wholly erroneous. There has been an attempt to carry the old and discarded ideas as to floral structure over into the new classification. The Conifers as described in this book should go back into their old position, sandwiched between the Monocotyledons and Dicotyledons!

In many points the "High School Botany," prepared by H. B. Spotton for the use of Canadian students, has a considerable resem-

blance to Miss Youmans's work noticed above. There is the same admiration and following of Henslow's "schedules" for analysis, the same examination of representative plants, while in each there are several chapters given to generalizations. Most of the work of preparing this volume appears to be well done, but there are evidences here and there of haste. Thus while the true nature of the lichens is recognized on page 202, a little further on (p. 206) we have the old statement that "the lichens, from their peculiar constitution, may be regarded as transitional between the Algæ and the Fungi." Here we have a little new wine (p. 202) in a very old bottle (p. 206). The "Flora for the Use of Beginners" in this book is much like Miss Youmans's "Popular Flora." It is really a very useful little manual.

A recent English book, Edmonds's "Elementary Botany," has been placed before the American public by Longmans of New York. It is a much more scientific book than either of the preceding, although like them it teaches botany by observation. The principal difference is that the observation in this book is more profound, and is directed to essential rather than to superficial characters. The student is brought to study the plant as a living thing, rather than an object to be classified and labeled. We find that while 153 pages are given to structure and physiology, but 35 are devoted to classification. A few orders are selected, and in each a typical plant is suggested for study, while a few others are cited as common examples. The book is a very good one.

Dr. Campbell's "Structural and Systematic Botany," which has recently been brought out by Ginn & Co., is an attempt to supply a small and handy introduction to all parts of the vegetable kingdom. It is based upon, and to a certain extent is an abridgement of, Goebel's "Outlines of Classification and Special Morphology of Plants," a work of great usefulness to the student in spite of its considerable cost. This introduction will be welcome to many a teacher and student who cannot afford the larger work.

After a few introductory pages devoted to methods of work, and a brief examination of the cell, the Protophytes are taken up, nine pages being devoted to them. Then follow in order the Algæ, Fungi, Bryophytes, Pteridophytes, and Spermaphytes. Very good outline drawings, largely original, accompany the text. A commendable feature of the work is the adoption of Eichler's arrangement of the flowering plants.

Here and there slips, due doubtless to haste, are noticed. Thus the figures B, C, and D, on page 132, are certainly not of "year-old cones of Scotch Pine," and on page 131 the relation of scale and "ovule-bearing leaf" are badly confused. There is also a looseness in

the quotation of the titles of works of reference and the names of authors and publishers on pp. 235-6. We note further that Ustilago is persistently spelled Ustillago.—CHARLES E. BESSEY.

The Completion of Saccardo's Sylloge Fungorum.—Eight years ago the first volume of this great work appeared, and this has been followed by others in rapid succession until now we have the eighth and final volume of the series. In these thick volumes, which aggregate more than eight thousand pages, nearly thirty-two thousand species have been described (exactly, 31,927). The completion of so great a labor in so brief a space of time must excite at once our wonder and admiration. We have here a work of vast extent, whose first and last volumes are near enough together in time, so that they are not appreciably separated by any change in plan, due to a change of view on the part of the authors. Whatever we may say of the plan of the work, and however much we may wish that a different one had been adopted, it is comfortable to know that here at least is a book completed upon the lines laid down by its author less than a decade ago. It is cheerful, also, to think that a generation has not died during the publication of the work, but that nearly all who saw its beginning have seen its completion. Thus the depressing influence of De Candolle's "Prodromus," dragging its way through fifty years to incompletion, is counteracted, and we may again hope to see great undertakings inaugurated.

If we take the great masses of families as worked in this book, and make a distribution in an approximately natural system, we get a better idea of the numbers and extent of the fungi. For convenience of reference the number of species in each family is given, and the total number in each order or class.

PROTOPHYTA.

MYXOMYCETEÆ.—(Vol. VII.)—Monadinaceæ, 49 species; Sorophoraceæ, 9; Myxomycetaceæ, 383. Total, 441 species.

SCHIZOPHYTA.—Schizomycetaceæ, 659 species. (Vol. VIII.)

ZYGOPHYTA.

CONJUGATÆ.—Protomycetaceæ, 19; Chytridiaceæ, 132. (Vol. VIII.); Entomophthoraceæ, 20; Mucoraceæ, 200. (Vol. VII.); Total, 371 species. (Vol. VII.)

OÖPHYTA.

CŒOELOBLASTEÆ.—Saprolegniaceæ, 80; Peronosporaceæ, 96. Total, 176 species. (Vol. VII.)

CARPOPHYTA.

ASCOMYCETEÆ.

PYRENOMYCETEÆ.—(Vols. I., II., and Add.)—Perisporiaceæ, 481; Sphæriaceæ, 5448; Coryneliaceæ, 2; Hypocreaceæ, 640; Dothidiaceæ, 351; Microthyriaceæ, 65; Lophiostomaceæ, 213; Hysteriaceæ, 372; Hermihysteriaceæ, 3. Total, 7575 species.

HYPODERMEÆ.—(Vol. VII.)—Uredineæ, 1224; Ustilagineæ, 284. Total, 1508 species.

— ? —

Phymetosphæriaceæ, 16; Onygenaceæ, 6; Laboulbeniaceæ, 15. Total, 37 species. (Vol. VIII.)

SPHÆROPSIDEÆ.—(Vol. III.)—Sphærioidaceæ, 3690; Nectrioidaceæ, 44; Leptostromaceæ, 203; Excipulaceæ, 143. Total, 4080 species.

— ? —

Melanconiaceæ, 606 species. (Vol. III.)

HYPHOMYCETEÆ.—(Vol. IV.)—Mucedinaceæ, 1147; Dematiaceæ, 1579; Stilbaceæ, 344; Tuberculariaceæ, 594. Total, 3664 species.

SACCHAROMYCETEÆ.—Saccharomycetaceæ, 30 species. (Vol. VIII.)

DISCOMYCETEÆ.—(Vol. VIII.)—Caliciaceæ, 78; Gymnoascaceæ, 51; Cordieritaceæ, 5; Patellariaceæ, 161; Phacidiaceæ, 268; Stictaceæ, 229; Bulgariaceæ, 152; Dermateaceæ, 255; Ascobolaceæ, 130; Pezizaceæ, 1948; Heloellaceæ, 169; Cyttariaceæ, 7. Total, 3453 species.

TUBEROIDEÆ.—(Vol. VIII.)—Elaphomycetaceæ, 21; Cenoccocaceæ, 1; Tuberaceæ, 102; Endogonaceæ, 6. Total, 130 species.

BASIDIMYCETEÆ.

GASTEROMYCETEÆ.—(Vol. VII.)—Hymenogastraceæ, 78; Lycoperdaceæ, 426; Nidulariaceæ, 61; Phallaceæ, 81. Total, 646 species.

HYMENOMYCETEÆ.—(Vols. V. and VI.)—Tremellaceæ, 258; Clavariaceæ, 371; Thelephoraceæ, 884; Hydnaceæ, 427; Polyporaceæ, 1972; Agaricaceæ, 4639. Total, 8551 species.

There are thus 1100 species of Protophytes; 371 of Zygophytes; 176 of Oöphytes, and 30,280 of Carpophytes. Of the latter again there are 12,703 Ascomyceteæ; 9,197 Basidiomyceteæ, with 8,380 probably, but not certainly, imperfect stages of the former.

CHARLES E. BESSEY.

The Preparation of Vegetable Tissues for Sectioning on the Microtome.—Vegetable tissues vary so much as to the amount of protoplasm, cellulose, and other substances contained, that the

methods used for obtaining good sections from them must vary greatly. I have prepared and sectioned fungi, lichens, the cotyledons, plumules, hypocotyledonary stems, roots, and root-tips of the cucumber, young pine cones, young wheat blades, lilac buds, and bean stems, with varying degrees of success.

Lichens, and the young firm cotyledons of the cucumber could be dehydrated, and permeated with paraffine much more rapidly than young meristemic tissue, or tissue composed largely of cellulose and water. The former may be placed in 50 per cent., 75 per cent., 90 per cent., and 100 per cent. alcohol, chloroform, chloroform and paraffine, and finally in paraffine, at a temperature of 55° C., remaining in each from two to twelve hours, and good results may be obtained.

But the meristemic and the thin-walled watery tissue must be treated differently, or the tissue will come through very much shrunken and distorted—worthless biologically.

I have had the most success following the method described by Dr. J. W. Moll, in the *Botanical Gazette* for January, 1888. I have obtained good sections from all the material that I have treated in this way. I used a 1 per cent. solution of chromic acid and 20 per cent., 35 per cent., 50 per cent., 75 per cent., and 90 per cent. alcohols for dehydrating. The chromic acid seems to fix the protoplasm, and macerate the cellulose, allowing the alcohols to pass more freely. I allowed the specimens to remain in the several per cents. of alcohol from two to twenty-four hours, according to their size and texture. As as rule, I found that the more gradually the specimens were dehydrated the better. From absolute alcohol, the specimens were placed in a solution of equal parts of turpentine and paraffine. The solution containing the specimens was then raised gradually from a temperature of 20°+ C. to about 45° C. They were then placed in melted paraffine, kept as nearly at 50° C. as possible. Small specimens will be permeated in one or two hours, but large specimens require from four to six hours.

From the 75 per cent. alcohol I placed the specimens in a stain. The stains I tried were alum cochineal, hæmatoxylin, fuchsin, methyl green, methyl blue, methyl violet, and ammonia carmine. I found alum cochineal a good stain for fungi, plumules, stems, roots, and root-tips, but it would not penetrate the cucumber cotyledons, Fuchsin would penetrate anything I tried; but as it is soluble in alcohol it is necessary to over-stain the specimens, and then allow the coloring to come out until it is about right. Hæmatoxylin stained all the tissue that I tried except the young cucumber cotyledons. This stain gives

large specimens a dark blue color on the outside, and a purplish pink color on the interior. The nuclei and the cell walls are brought out clearly. I did not have good success with the methyl colors, as they were easily dissolved out by the alcohol.

If specimens have not taken sufficient color, or if the alcohol has removed too much of the color, sections can be stained upon the slide, after they are cut. Any stain can be used, but none that I tried differentiated the parts sufficiently. Fuchsin will give enough color in a few seconds. The sections must stand in hæmatoxylin from two to ten minutes, and in alum cochineal from ten to twenty minutes. If it is intended to stain upon the slide, an alum fixative will be found better than collodion.

I heated the slides in the gas flame to melt the paraffine, and poured on turpentine to wash it out. The specimens were then mounted in balsam dissolved in chloroform. Air bubbles that appear when sections are first mounted, will disappear after the slides stand a few hours. If the razor or knife used for cutting is very sharp, small specimens may be cut 1-2500, or even 1-5000 of an inch in thickness. But larger specimens cannot be cut more than 1-600 to 1-1500 of an inch thick without crowding the tissues together, and giving them the appearance of being shrunken.—A. J. McClatchie, *Lincoln, Neb.*

ZOOLOGY.

The Ontogeny of Limulus.—The following is preliminary to a more detailed account, with ample illustrations, which will be published soon. The work was done in the Marine Biological Laboratory at Woods Holl, Mass., during the summers of 1889 and 1890. In my views of the earlier stages, as seen from the surface, I fail to corroborate Osborn's account[1] in many particulars. The eggs were artificially fertilized, and were carried through until hatching.

(1) The segmentation nucleus is subcentral, and is surrounded by a thin pellicle of protoplasm. It undergoes several divisions before any signs of segmentation are visible from the surface. The products of this division migrate more rapidly toward that pole of the egg where the germ is subsequently to appear than to any other portion of the surface. Forty hours after impregnation the egg itself begins to segment, and this segmentation has in its general appearance a meroblastic character,

[1] Johns Hopkins University Circular, No. 43, 1885.

recalling to a slight degree Metschnikoff's,[2] Pl. XIV., Fig. 5. The result of this yolk segmentation is to divide the egg into a number of yolk cells, in the center of each of which there is a nucleus with its thin layer of protoplasm.

(2) The result of migration of the products of egg and nuclear segmentation is the formation of a blastoderm at first on one side of the egg, the cells of which are smaller and less charged with yolk than those of the rest of the ovum. At this time surface views show no traces of regularity. At one pole are numbers of poorly-defined small cells, while at the other the cells are greatly larger and fewer in number. The blastoderm thus formed produces a lighter spot on one side of the egg, which strikingly resembles the primitive cumulus of the Arachnids. With the formation of this blastoderm the secretion of the blastodermhaut (amnion of Packard, deutovum of my former paper[3]) begins.

(3) In from eight to eleven days after impregnation (the period varies in eggs of the same lot) a small circular pit appears in the center of the primitive cumulus. This I regard as the blastopore. This soon becomes triangular and then elongates, while on the next day a second cloud appears behind the first, but connected with it. At first the second cloud is smaller, but it rapidly attainse quality with the primitive cumulus, and soon surpasses it. During this process the outlines become indistinct, more so than in Balfour's[4] Pl. XIX., Fig. 1, which in other respects, except in length, agrees well. During this process the blastopore increases in length backwards, in the shape of a shallow groove (primitive groove), the enlarged anterior end of which continues to mark the original site of the first appearance of the structure. This primitive groove runs back into the posterior cloud and fades out behind. A second lighter area has now become prominent along the margins of the blastopore and its posterior continuation, produced by the proliferation, as shown by sections, of mesodermal cells from the margins. These wander in between the rest of the blastoderm (ectoderm) and the yolk (entoderm) cells which occupy the interior. Gastrulation produces no entoderm.

(4) In fifteen days this primitive groove has become less distinct, through the flattening of its walls; while the germinal area, now outlined by the limits of the extension of the mesoderm, has become divided by the appearance of a transverse groove into cephalic and post-

[2] Zeitschr. f. wiss. Zool., XXI, 1871.

[3] *Quarterly Jour. Micros. Sci.*, XXV., 1885.

[4] *Q. J. M. S.*, XX., 1880.

oral plates, the anterior being smaller and more sharply limited than the other. In twelve hours more a second groove appears behind the first, cutting off a narrow ridge, the first post-oral somite. At this stage the embryo is readily comparable with Metschnikoff's Pl. XVII, Fig. 3, except in the following particulars: The two ends of the embryo are more nearly equal, the single somite developed is much shorter, and the median groove is fainter and extends into both cephalic and caudal plates. Successive somites are added by budding from the caudal plate until the number six is reached. The embryo now closely resembles Balfour's Pl. XIX, Figs. 3*a* and 3*b*, except that it covers far less of the surface of the egg, the first somite is separate from the cephalic plate, the primitive groove extends across the somites, its anterior end terminating at the mouth, while posteriorly it runs into the caudal plate: the caudal plate is much smaller than in Balfour's figure.

(5) Just after six somites are formed, paired thickenings, the rudiments of legs, arise near the outer margins of each. Then six pairs arise simultaneously. I have seen no traces of Osborn's semicircular groove.

(6) Almost simultaneously with the outgrowth of the legs, paired thickenings for the nervous system appear. There are a pair of these in each somite of the body, while three pairs appear in the cephalic plate. A few days later a series of six pairs of segmentally arranged sensory thickenings arise outside of the legs, and extend in a line from the cephalic lobes backwards, as briefly described by Patten.[5] These have different fates. The first pair gives rise to the median ocelli of the adult; the second to a peculiar sense organ as yet undescribed, occurring on the thin skin just in front of the first pair of appendages; the third soon disappeares; the fourth forms the "dorsal organ" of Watase, which persists longer than the third; the fifth gives rise to the paired compound eyes; while the sixth is evanescent. At first these are all similar and are plainly sensory. These organs are connected with each other and with the brain by a longitudinal nerve, which takes an undulating course between the organs and the bases of the legs.

(7) There is a precocious separation of ectoderm and entoderm (yolk cells) during the formation of the blastoderm. Blastopore and primitive groove produce no invagination of entoderm cells. The entoderm retains its primitive character as a solid mass of large yolk cells until after the caudal spine appears. The yolk cells are not true

[5] *Jour. Morphology*, III.

vitellophags. They metabolize the yolk which is contained in each, but the cells themselves are directly converted into the lining epithelium of the mid gut. By this process a lumen is formed, first at the anterior end. The stomodeal-mesenteric wall is first to break through; the opening into the proctodeum appears much later. The proctodeum is very short, not extending far from the anus.

(8) In embryos at the time of hatching the sternal artery has arrived at the condition found in the adult scorpion. It consists of a tube lying on the upper surface of each half of the œsophageal nerve ring. Not until much later than my studies have gone does it attain the investing character of the adult.

(9) Packard's "brick-red gland" is of mesodermal origin. It contains in its interior the cavity of the fifth post-oral somite. Its inner end is terminated by a thin layer of flattened epithelium. It soon becomes folded on itself, and the region of the bend grows rapidly forward. The outer limb of the fold becomes in turn folded at four points, and these new bends grow out in each body segment, giving rise to the lobes characteristic of the organ in the adult. With the folding numerous fusions of the walls occur, followed by perforations, giving rise to the peculiar anastomosing structure of the adult organ.

These points, so briefly summarized, go far, I think, toward the support of that view which would recognize a close relationship between Arachnids and Limulus, while at the same time they serve to remove the Merostomata more widely from the Crustacea.—J. S. KINGSLEY, *July 17, 1890.*

A Review of Some of the North American Ground Squirrels of the Genus Tamais.—By J. A. Allen.—Bull. Am. Mus. Nat. Hist., Vol. III.—This paper is a revision of the "*Tamais asiaticus*" group of a former monograph of the genus Tamias, made necessary by the accumulation of a variety and quantity of new material during the last five years. It is a valuable contribution to mammalian literature.

The material in hand seems to require the provisional recognition of not less than twenty-four forms, of which thirteen are here for the first time described. These twenty-four forms fall into several more or less well-marked groups, as follows:

1. The *hindsii* group, consisting of (1) *T. hindsii*, (2) *T. townsendii*, (3) *T. macrorhabdotis*, (4) *T. senex*, (5) *T. quadrimaculatus*, (6) *T. merriamii.*

2. The *dorsalis* group, consisting of (1) *T. dorsalis*, (2) *T. obscurus.*

3. The *umbrinus* group, consisting of (1) *T. umbrinus*, (2) *T. cimereicollis*, (3) *T. bulleri.*

4. The *quadrivittatus* group, consisting of (1) *quadrivittatus*, (2) *T. luteiventris*, (3) *T. affinis*, (4) *T. neglectus*, (5) *T. borealis*, (6) possibly also *T. gracilis*.

5. The *minimus* group, consisting of (1) *T. minimus*, (2) *T. consobrinus*, (3) *T. pictus*.

6. The *frater* group, consisting of (1) *T. frater*, (2) *T. amœnus*.

T. speciosus is a rather isolated species, more closely resembling *T. frater* than any other form. *T. asiaticus* has no close affiliation with any of the American forms.

A table of measurements, a "key" giving the salient features of the various forms of Tamias, and a diagram indicating the status, relationships, and lines of probable intergradation, accompany the paper, and make it a complete exposition of the group considered up to date.

PHYSIOLOGY.

Functions of Central Nervous System of Invertebrates.—Steiner[1] endeavors to determine experimentally what ought to be regarded as the the brain of those invertebrates that possess a supra-œsophageal ganglion, œsophageal commissure, and ventral ganglia. He regards the brain as characterized by the presence of the general motor centre in connection with at least one of the nerves of the special senses. In the crustaceans (Astacus, Carcinus, and Maja) removal of one-half of the supra-œsophageal ganglion, or cutting of the œsophageal commissure, caused circular movements toward the uninjured side. This indicates the presence of the general motor centre in the ganglion, and since it also gives origin to the nerves of the higher senses, the author regards it as the brain of the crustaceans. Experiments on insects (Blatta, Blaps, Carabus, Geotrupes, Musca, Vespa, Pieris, Papilio), and on myriapods (Julus), gave similar results. In molluscs (Pterotrachea, Pleurobrachea, Aplysia) destruction of even the whole of the supra-œsophageal ganglion did not affect the movements, but the latter ceased as soon as the pedal ganglion was destroyed. In Octopus, after destruction of the dorsal ganglion, the movements took place normally, but only after stimulation, never spontaneously. This ganglion hence appears to perform the part of a cerebrum instead of a whole brain. Among annelids (Ophelia, Eunice, Diopatra, Nephthys) cutting the œsophageal commissure caused disturbance of movement.

[1] Sitzber d. königl. Preuss. Akad. d. Wissensch. zu Berlin, 1890. II., p. 39. Cf. *Centralb. f. Physiologie*, Bd. IV., p. 180, 1890.

In the author's sense, then, the supra-œsophageal ganglion is a proper brain only in the arthropods; in the molluscs and annelids it is only a sense centre. In arthropods, especially crustaceans, evidence was obtained of a crossing of the nerve-paths in the sub-œsophageal ganglion, analogous to the decussation of the pyramids in the medulla of vertebrates.

Cerebral Localization.—The well-known statistician, Bertillon, was deaf in his left ear from his tenth year, and was also left-handed. Manouvrier[2] publishes the results of a detailed examination of his brain. The right superior temporal convolution (position of centre of hearing) was narrow, straight, and poorly developed, while that of the other side was broad, winding, and provided with secondary sulci. In accordance with the presence of left-handedness, the speech centre was to be looked for upon the right side; and accordingly Broca's convolution on that side was considerably more developed than upon the left. Bertillon, therefore, "spoke with his deaf hemishere," which must be regarded as an unfavorable relation, and with this must be associated the difficulty of speech from which he suffered in life. The right sight centre was especially strongly developed, which is regarded by the author in the light of a compensation for the poor sense of hearing. The results go far to confirm the localization theories.

ENTOMOLOGY.

The Black Harvest Spider.—In a lot of Phalangiidæ, received from Mr. Lawrence Bruner, and collected at Lincoln, Nebraska, I found a number of specimens of the species described by Say and Wood as *Phalangium nigrum*. Its characters at once place it not only out of the genus in which it is at present retained, but also out of the sub-family *Phalangiinæ*, as it belongs to the *Sclerosomatinæ*, being the first species of this sub-family to be recognized in our fauna. It apparently falls into the genus Astrobunus Thorell, and hence should be known as *Astrobunus nigrum* Say.

The literature of this Harvest Spider is quite limited. Originally described in 1821 by Thomas Say,[1] who reported it as "not uncommon in the Carolinas and Georgia," it received no further mention

[2] *Bull. d. l. Soc. d. Psychologie Physicol.*, 1889, p. 24. Cf. *Centralblatt f. Physiologie*, IV., p. 180, 1890.

[1] Jour. Phila. Acad., VI., pp. 66-67. Compl. Writings, II., p. 14.

until 1868, when Dr. H. C. Wood again described it[2] from specimens collected in Nebraska and Texas. Bibliographical references to it have also since been published by Professor L. M. Underwood[3] and myself.[4]

It is a little strange that this species does not occur in collections of Phalangiidæ from North Carolina and Alabama, kindly sent me by Professor Geo. F. Atkinson. As already noted, Say says it is not uncommon in the Carolinas and Georgia. Dr. Wood says of his Texas and Nebraska specimens: "The form just described has been recognized as *P. nigrum* Say, but as there are some slight disagreements with the description of that authority, and the localities are widely separated, it is possible that it is a distinct species." My specimens are undoubtedly the form described by Wood, and if another species should be discovered in the region mentioned by Say—agreeing with his brief description and differing from the Western form—the latter, of course, would have to be re-named.

This species may be described as follows:

Male (plate).—Body, 6 mm. long; 3.5 mm. wide; Palpi 4 mm. long. Legs, I., 11 mm.; II., 18 mm.; III., 11 mm.; IV., 17 mm.

Black: Ventrum of cephalothorax (including coxæ), trochanters, and base of femora, brown. In some specimens the apical portion of the legs and more or less of the ground color of the dorsum is brownish black. Dorsum thickly studded with small hemispherical black granules or tubercles. Segmentation of abdominal scutum indicated by faint impressed lines. Eye eminence longer than high; not canaliculate; covered with black tubercles like those on the dorsum. Palpi black, except coxal joint, which is brown; all the joints slightly arched; furnished with more or less scattered tubercles and spinose hairs. Mandibles blackish. Legs short, robust, granulate. Ventral surface of abdomen brownish black, granulate. Genital organ "slender, proximally sub-cylindrical, then flattened and slightly expanded, then rapidly expanded into a broad, somewhat circular, very thin, alate portion, then suddenly contracted and bent at an obtuse angle, ending in a very fine point."[5]

Female.—Body, 9 mm. long; 5 mm. wide. Legs, I., 11 mm.; II., 20 mm.; III., 11 mm.; IV., 19 mm. Besides its larger size, it differs from the male in having less black on the ventral surface, which is

[2] Communications Essex Institute, VI., pp. 34-35.

[3] Canadian Entomologist, XVII., p. 168.

[4] Bull. Ill. St. Lab. Nat. Hist., III., p. 105.

[5] Wood, *l. c.*

cinnamon rufous, spotted with black; mandibles brown, black above; and the outer margins of the dorsum smooth, without the black tubercles which form a large, distinct, quadrangular, plate on the middle of the abdomen, and a transverse plate on each of the three posterior segments. The smooth margins are dark brown.

Described from eight males and one female collected at Lincoln, Nebraska. The species is well illustrated, both natural size, and with the parts magnified (at Plate XXIV), the drawings for which have been prepared for my assistant, Miss Freda Detmers.—CLARENCE M. WEED.

EXPLANATION OF PLATE.

FIG. 1. *Astrobunus nigrum* Say, male, natural size.

FIG. 2. Parts of same, magnified: *a*, dorsal surface of body; *b*, eye eminence, side view; *c*, eye eminence, front view; *d*, palpus, side view; *e*, claw of palpus, side view.

The Live Oak Caterpillar.—In a recent number of *Zoe*, a new biological journal published at San Francisco, H. H. Behr adds another insect to the list of those which the English sparrow indirectly protects. He says: "There exists around our bay a moth, *Phryganidia californica*, which lives exclusively on live oak, though I have lately found some stray larvæ on *Quercus lobata*. When, in 1853, I first found the caterpillar of this species I considered it a great prize, so rare was the little thing. Gradually the insect became less rare, and as soon as a sufficient number of shot-guns were placed in the hands of boys who shot little birds, I had ample opportunities to fill the empty spot in my collection that for years had only the male of the species on a pin.

"I have counted four generations of the insect in one summer. Nevertheless they did not endanger the life of the trees inhabited by them. There existed still a sufficient number of insect-feeding birds to decimate the four broods, especially a species of titmouse, then rather common in our surroundings, and very frequent in Marion county, which took care of the eggs and the adult caterpillars. This bird managed in some way to escape destruction by the shot-gun; but then the English sparrow was introduced by some well-meaning but imperfectly instructed people. The sparrow soon drove away the titmouse. The titmouse no more decimated the Phryganidia egg and larva, at both of which the sparrow looked with a contemptuous smile. The Phryganidia multiplied in mathematical progression; the leaves of the live oaks, for instance, at San Rafael, disappeared four times a sum-

mer; some trees survived, other succumbed; and so the introduction of the English sparrow destroyed our California live oaks. The best proof of this is that the destruction coincides with the spreading of the sparrow."

Bibliography of Economic Entomology.—The first three parts of the Bibliography of the More Important Contributions to American Economic Entomology, which has been in preparation by the U. S. Department of Agriculture since 1882, have just been issued. They comprise the writings of B. D. Walsh (Part I.); Walsh and Riley (Part II.), and C. V. Riley (Part III.); there being in the first 385 entries, in the second 479, and in the third 1556. The work has been prepared by Dr. Samuel Henshaw, and bears evidence of having been carefully done. It is accompanied by a very complete index, which will be appreciated by every working entomologist.

Entomological Notes.—The current number of the Transactions of the American Entomological Society (Vol. XVII., No. 1) contains two valuable papers by Dr. G. H. Horn on the North American species of Heterocerus and Oethebius; a similar discussion of the species of Dendroctonus by Dr. W. G. Dietz; descriptions of three new species of North American Odonata, and notes on three others, by Philip H. Calvert; descriptions of a number of new species of Agrotis, by John B. Smith; and a valuable paper by H. F. Bassett on new species of Cynipidæ.

Prof. G. F. Atkinson's excellent paper on Nematode Root-Galls (*Heterodera radicola*) has been republished in the Journal of the Elisha Mitchell Scientific Society (Vol. VI., pp. 81–130).

In the same journal (pp. 134–147), Prof. W. L. Poteat presents some interesting notes on the architectural and feeding habits of a tube-building spider (*Atypus niger* Hentz).

Mr. E. A. Schwarz has published (Proc. Ent. Soc. Washington, Vol. I., pp. 237–247) an important paper on the Myrmecophilous Coleoptera found in temperate North America. A list of the beetles and their hosts is given.

Prof. J. B. Smith has published, as Special Bulletin K, of the New Jersey Experiment Station, an extended report upon the cranberry insects of that State.

Bulletin No. 1 of the Colorado Biological Association contains a valuable paper on the Hymenoptera of Colorado, by William H. Ash-

mead. This is a part of the natural history survey of the State undertaken by the Association, and the paper is based largely upon material furnished by the Secretary, Mr. T. D. A. Cockerell. Three new genera are characterized, viz., Neolaraa, of the family Bembecidæ; Microbracon, of the Braconidæ, and Dolichopselephus, of the Ichneumonidæ. Sixty-seven new species are described, the descriptions of forty-one of which were drawn up from single specimens. The hymenopterous fauna of the State, so far as it is now known, includes 33 families, 247 genera, and 897 species.

ARCHÆOLOGY AND ETHNOLOGY.

On the Use of the Phonograph Among the Zuni Indians.—Ever since I began my work with the phonograph as a means of preserving the language of the American Indians, I have looked forward with great interest to a visit to some of those tribes which still remain in approximately the same condition that they were when first visited by white men. Such tribes it is almost impossible to find now in the confines of the United States. But there are some which have been very little changed.

I have been particularly anxious to make observations among the Pueblo Indians, which still possess many interesting features of great antiquity. Of all the Pueblos, except possibly the Moquis, the Zuñians, or A'sheewee as they are called in their own tongue, have been least changed from their original condition by contact with Europeans. Living at a distance from the railroad, inhabiting isolated regions difficult of access, these people have preserved the ancestral traditions and customs in their primitive form. In many ways they offer an unparallelled opportunity for the study of the religious and secular celebrations of Pueblo Indians, slightly modified from the olden time.

A previous visit to Zuñi, in the summer of 1889, had inspired in me a wish to attempt to record on the cylinders of the phonograph the songs, rituals, and prayers used by these people, especially in those most immutable of all observances, sacred ceremonials. I was particularly anxious to record the songs connected with the celebration of the mid-summer dances, which occur at or near the summer solstice. By the help of Mrs. Hemenway, of Boston, it was possible for me, in the interest of the Hemenway Expedition, to visit Zuñi Pueblo at this time, and I have been fortunate enough to take on the phonograph,

from the lips of the Zuñians, a series of records illustrating the songs used in their sacred and secular observances. An extended paper, with illustrations of the dances, has been prepared for publication, and will be printed as soon as the music can be written out by an expert from the cylinders of the phonograph. Although I prefer not to publish my final contribution until the illustrations are prepared from my photographs, a brief notice of some of the phonographic records which I have may not be without interest.

One of the most interesting of the songs sung at this dance, which is called the Kea' kok' shi or good dance, is that of the Kō kō. This song I took directly from the lips of one of the participants in the dance. I have reason to believe that this song is improvised each year, as the music this summer is quite different from that of a year ago. I was told by the Zuñians before the dance that they did not know what the song was to be, and that no one knew except the participants. There is, however, a general resemblance, yet still great variety, in all these "Kō kō songs," and I have indelibly taken on phonographic cylinders as many as possible for a comparative study at a more favorable opportunity.

The possibility that the songs of the Kō kō were originally imitations of the wind blowing down the fireplace or around the house, is a fascinating idea which hardly seems capable of proof or the contrary. There are often strains in the Kō kō songs that remind one of the wind, and it is right appropriate that such imitations should occur in dances instituted for rain, which is ordinarily associated with the wind. At this place it may be well to mention the fact that there is introduced into the dance an implement to imitate the wind. On the entrance of the Kō kō into the Pueblo, and during the dances, the clowns or other persons, generally the clowns, have a small stick fastened to a buckskin thong, which they whirl about in a circle, making the sound of the wind. This implement, which is the exact counterpart of the "bull roarer," so well known to boys in some English communities, is called the wind. I cannot discover that it is used in the sacred ceremonies to frighten the women and children, or those who do not take part in the dance. Sometimes it is even used as a plaything by the Zuñi boys. In Australia an instrument almost exactly similar is used in sacred ceremonies to frighten those who do not take part, or to let them know that exercises are in progress, for which purpose its use was not unknown among the ancient Greeks.

Four days before the dance, on the afternoon before the departure of a delegation of priests to offer feather plumes at the "Sacred

Lake," Tay jay po une, a ceremony takes place in the Pueblo, which may be called the "Ducking of the Clowns." This observance is known to the Zuñians as the Dumāchimche, from the words of the song by the Ko ye a mashi, or mudhead clowns, on whom, in the course of the celebration, water is poured from the housetops by the squaws. This song has internal evidence of antiquity, and I am told by the Indians that both song and ceremony is very ancient. Although a musical critic might not find in it great beauty, as an undoubted specimen of ancient aboriginal music it is very interesting. I shall comment on the meaning of the Dumāchimche in another place, when the ceremony will be described at length.

A survival of the old practice of communal hunting still exists in some of the Pueblos in the so-called rabbit hunt. Several of these hunts have taken place during my residence in Zuñi. It has seemed to me that it is a semi-religious observance connected with summer dances, and I have therefore taken records of the song and prayer used by the hunters for future study.

While my observations have been particularly directed to the linguistic features of the solstitial dances in summer, I have not wholly neglected the great wealth of other material all about me for linguistic study by means of the phonograph.

The well-known celebration called the Sha' la 'ko, at which the Zuñi house is consecrated, is the occasion of an elaborate ceremonial, in which figures a song or chant and a prayer, said to be very ancient. I have never witnessed the celebration of the Sha' la 'ko, but have been able to obtain the chant and prayer from one of the natives. This capture had to be made secretly, unknown to the other Indians. It was found necessary to take it late at night, in a room darkened with blankets at the windows to prevent suspicion, and sentinels stationed about the house to warn us of the approach of intruders. On those conditions only was it possible to get the Indian to chant the Sa' hla 'ko on the phonograph. It is now, however, permanently recorded in the wax, and can be reproduced at pleasure, or what is of more importance to philological study, can be written out and studied at leisure under better conditions. I am told that it is next to impossible to get any of the Zuñians to sing the Sha' la 'ko out of season, and as the celebration regularly comes in November, a record of it in July is a fortunate acquisition. Certain of their winter songs they will not sing in summer, because to do it prevents the corn from growing. I do not know whether or not the chant of the Sha' la 'ko is one of these.

The phonographic record to which I look forward with the greatest hope is that of a Zuñi ritual to which writers have from time to time referred. This ritual, which has been designated by the dignified title of a Zuñi Epic, is of considerable length, and is regarded with great reference by the Zuñi people themselves. Haluta, the reciter of it at the time of its delivery, is said to be regarded as a most sacred personage, and when, prior to its recital, he is brought into the Pueblo his feet, it is said, are not allowed to touch the ground. It is thought probable that a phonographic record of the ritual would be an addition to our knowledge of Zuñian mythology.

The extracts from this ritual, which are freely translated from memory by Mr. Cushing in his interesting paper on Zuñi Fetishes, indicate that it is a valuable account of the mythological history of the race. He had not at his command an instrument to record the words of those portions of the "Kaklan" which he heard, and consequently was unable to give it in the original diction in which it is given before the members of certain priesthoods, to whom alone it is recited. He says that many of the words are in old Zuñi, not understood at present. The records which I have are good enough to enable me to write out the ritual, which, however, at the present state of my knowledge of the language I am unable to translate. With the help of those who understand the language, as well as English, I have no fear but that in my final paper I can publish a translation of the ritual as told by Haluta on the cylinder of the phonograph.

I have, after several failures, been able to get this recital on the phonograph, where it fills a long series of cylinders. Before the value of this record, both linguistic and mythological, can be appreciated, it must be carefully written out and studied. This will take a long time, as many of the words are old Zuñian, and the task of extracting the meaning from the ritual will found to be a difficult one. A permanent preservation of it is, however, a step in the interpretation, and when once indelibly fixed on phonographic cylinders its true character and significance can be investigated.

One of the most interesting of the Zuñi songs is that of the hunters. This song has many beautiful parts in it, and outside of its interest in the study of the customs of the hunters, is well worth preserving as a specimen of aboriginal music. I have thought it worthy of a place in my collection, and with it I have also preserved certain of the prayers to the fetishes used in the hunt, some of which have been written out and translated by Mr. Cushing. The harvest which a study of the hunting customs of the Zuñians offers is great, and the collection of

data bearing on this subject is highly important, since the decrease in game may on as New Mexico is more and more thickly settled, and the hunting ceremonials be more or less modified as time goes on.

I have not encountered in my experience in taking records with the phonograph any very great difficulty among the Zuñians. Their real impressions of the instrument it is very difficult to divine. One of them asked if a person was hidden in the machine, and another thought the phonograph bewitched. Indians are so stolid that it is very difficult to discover what impression such a novel instrument as the phonograph really makes. They are so accustomed to incomprehensible machines used by Americans that this last triumph of inventive genius affects them no more than many others which might be mentioned. Certainly they are not afraid of it, and there is no difficulty in getting them to talk into the instrument. The great difficulty in getting them to repeat their sacred songs and prayers does not come so much from their fear of the instrument as of secularizing what is sacred to them. They will readily respond with any of their secular songs, or with those sung in public, but those belonging to the secret ceremonials of the Estufa they will not divulge.—J. WALTER FEWKES, *Zuni, New Mexico, July 5th, 1890.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington.—May 31.—The following communications were read: Characteristics of the Halosauroids or Lyopomes; Dr. Theo. Gill. Exhibition of Specimens of New Species of North American Mammals; Dr. C. Hart Merriam. *Coultorella* a New Genus of *Compositæ;* Dr. J. N. Rose. Organisms in the St. Peter's Sandstone; Prof. Joseph F. James.—FREDERIC A. LUCAS, *Secretary.*

Natural Science Association of Staten Island.—May 8, 1890.—The following paper by Mr. Chas. W. Long was read: Staten Island Fire Flies.—No one will have failed to notice the abundance on Staten Island of the beetle commonly known as the firefly. As it is seen in early summer, in the words of Longfellow:

> "Flitting through the dusk of evening,
> With the twinkle of its candle,
> Lighting up the brakes and bushes,"

it constitutes one of the peculiar charms of our latitude. It has been described by many a poet as well as naturalist, and those who have

watched it through a warm June night will not wonder that the naturalist, like Mr. Silas Wegg, may be tempted to "drop into werse." No prose can perfectly represent the mazy evolutions of its flight, but the following from the pen of Mr. Philip Gosse will be found the most accurate: "They fly slowly, and as they fly, emit and conceal their light at intervals of two or three seconds; making interrupted lines of light through the air, gleaming slowly along for about a yard, then suddenly quenched, and appearing again at the same distance ahead." He, like Longfellow, compares the light to candles in the woods. Indeed he says though told what they were, at every one that appeared, the same idea would come across his mind, but the comparison is not so apt with us, for we rarely see them singly, and it rather seems as if they were stars moving through the bushes, or twinkling in some deep valley as we look into it from the hills above. They resemble the stars, too, in the thought of infinite number they suggest. It would be a hopeless task to count the number one can see in a single summer night. And considering the countless summer nights that have elapsed since the first firefly appeared on the globe (fossil Lampyridæ are found in Miocene rocks) the total of all the motions that they have made since then may well suggest a number approaching to mathematical infinity.

Apart from their beauty, our fireflies possess a great interest from the entomologist's point of view, for we find in them some characters specialized to an extraordinary extent. It is unfortunate that among the nine or ten species represented on Staten Island, of which I append a descriptive list, the special sexual characters are not developed as fully as in the Southern species and in the English "glow worm." In the latter, the light organs of the female reach their highest point and she is destitute of wings, while the male possesses normal wing power and very large eyes; clearly indicating the relation of the characters to the reproduction of the species. The light organs of the male are feeble, being useless as an attraction to the female, able only to crawl slowly in the grass. The same characters are found in some of our Texan species, but the only approach to it among the Staten Island species is in *Photinus scintillans*, our most abundant "firefly," of which the female is wingless. The eyes, however, and the light organs are equally developed in each sex.

The antennæ also present some curious forms, none more so than those of *Phengodes plumosa*, a southern species whose occurence on Staten Island was discovered by Mr. W. T. Davis, to whom I am indebted for my specimen. Here the antennæ consist as usual of

eleven linear joints, from each of which proceed two branches, as long as the entire antennæ, curved and fringed both sides with long hair. The branches become shorter toward the outer extremity, and the effect is very similar to a white ostrich plume. The females of this and all the species of Phengodes are unknown. Beyond these characters, the fireflies resemble the general coleopterous form. It is not difficult to catch and examine one, for they frequently rest on a stalk of grass, continuing to give out the intermittent yellow gleam, thus guiding one to the spot. In the hand the insect will be found to consist, seen from above, of the thorax in front, a semicircular piece ornamented with rosy patches and a black spot, and two "elytra," parallel yellowish pieces, comprising the greater part of the dorsal aspect. Beneath will be found the head, concealed from above by the hood-like thorax, with biting jaws; the six legs possessed by all beetles; and the abdomen, divided into segments, from the last three proceeding the light which gives the family its name and renown. The light may be watched, throbbing and pulsating, as the small creature silently tells that it, like its captor, lives and breathes. If it be crushed, the light still continues for a time, but gradually dies away. In the dried specimens these segments are cream colored. The physical cause of the luminosity in fireflies is unknown. Dr. Leconte cites some partially successful experiments to isolate the actual luminous substance by Dr. T. L. Phipson and others, and the name "Noctilucine" has been applied to it, and its existence stated in varied forms of marine life, in Myriapoda and in putrid fish, but I am not aware that positive results have been reached.

The larvæ of these insects are also somewhat luminous, and are found in the grass in summer. They are carnivorous, and are to be reckoned among the beneficial insects.

The description of the firefly is taken particularly from the species common in gardens, and the flight of that insect (*P. scintillans*) is also described, and as Mr. Davis has mentioned to me that the larger species have a more rapid flight, it is proper to so state here to guard against error.

This list of our species includes all known to me from the neighborhood of New York, and Phengodes is new to the fauna of the vicinity. Being the result of the observations of two persons only, it would be hazardous to represent it as complete, particularly in view of the warm and sandy character of the southern end of the island, where we may hope to find additions to our list. They may be sought by jarring the leaves and branches of shrubbery where they remain during the day.

LIST OF THE SPECIES OF SUB-FAMILY LAMPYRIDÆ.

Head more or less covered by the hood-like thorax; antennæ not plumose:

Head completely covered; 2d joint of antennæ small; transverse;

Antennal joints very broadly compressed; color black; sides and apical margin of thorax fulvous, .28-.44 ins. 1. *Lucidota atra.*

Antennal joints not broadly compressed;

Eyes small; color black; thorax fulvous, with disk and sides black; last dorsal segment in male rounded, .28-.54 ins. 2. *Ellychnia corrusca.*

Eyes small; last dorsal segment in male bisinuate and truncate;

Prothorax with black disk and reddish yellow sides, .25 ins. 3. *Pyropyga nigricans.*

Prothorax with black disk and edge, .25 ins. 4. *Pyropyga decipiens.*

Eyes large; prothorax subcarinate; elytra with wide side margin;

Elytra black, margin and suture yellow; thorax like No. 2, .30-.50 ins. 5. *Pyractomena angulata.*

Eyes large; prothorax not carinate; elytra without wide margin;

Larger species; female elytra long like male, .36-.52 ins. 6. *Photinus pyralis.*

Smaller species; female wingless, elytra short, .22-.32 ins. 7. *Photinus scintillans.*

Head only partially covered; 2d joint of antennæ not transverse, as long as 3d.

Color dull yellow; prothorax red on disk, with a dark medial stripe, elytra dull yellow, more or less striped with black, .42-.60 ins. 8. *Photuris pennsylvanica.*

Head exposed; antennæ plumose;

Elytra subulate, color testaceous, .50 ins. 9. *Phengodes plumosa.*

The length of the insect in 100ths of an inch is indicated before the name. The species numbered 4 and 5 are northern insects and rare with us, and No. 9 is, as stated above, a southern species. The light organs are more feeble in 1 to 5, and more strongly developed in 6 to 8, which are the common "fireflies."

A preliminary list of the mosses of Staten Island, compiled by Mrs. N. L. Britton, was presented, which will be published as an extra.

Mr. Arthur Hollick showed dried specimens of *Clematis ochroleuca*, collected during the past month at Richmond, which is a new locality for this interesting plant, or perhaps only an extension of the previously known localities on Todt Hill and at Egbertville. It was in great abundance, accompanied, as usual, by *Cerastium arvense*, var. *oblongifolium* in dense clusters, particularly where the serpentine had been exposed. Mr. Hollick also showed staminate catkins of *Salix fragilis*, from a tree in Richmond, which were bi- and tri-furcated. This peculiar state of the catkins of this willow was noted some years since on a tree at Prince's Bay (See *Bull. Torr. Bot. Club*, VI., 312), and it is not unlikely that it may be looked for in other places.

Mr. L. P. Gratacap presented a block of Potsdam sandstone, beautifully ripple-marked, from the drift at the base of the bluff on the shore at Tottenville. Also clay ironstone containing plant remains and nodules of pyrite from the same locality, and lignite from the clay beds near Kreischerville.

Mr. Ira K. Morris read a paper upon "Some Old Staten Island Springs."

American Association for the Advancement of Science, 1889.—REPORT OF THE COMMITTEE ON ANATOMICAL NOMENCLATURE, WITH SPECIAL REFERENCE TO THE BRAIN.—During the past year some of the members of the Committee have given to the subject intrusted to them as much time as their regular duties would permit. They agree upon one point, viz., the advantages, other things being equal, of *mononyms* (single word terms) over polynyms (terms consisting of two or more words). Before making specific recommendations or presenting a final report, the Committee think it advisable that they and other anatomists should have an opportunity of discussing at leisure the simplified nomenclature which they are informed is employed in certain treatises which will be published during the coming winter. They therefore ask to be continued.

BURT G. WILDER, *Chairman.*
HARRISON ALLEN,
FRANK BAKER,
HENRY F. OSBORN,
T. B. STOWELL,
Committee.

The Association of American Anatomists.—PRELIMINARY REPORT OF THE COMMITTEE ON ANATOMICAL NOMENCLATURE, ADOPTED DECEMBER 28, 1889, BY THE ASSOCIATION.—The Committee recommend:

1. That the adjectives *dorsal* and *ventral* be employed in place of *posterior* and *anterior* as commonly used in human anatomy, and in place of *upper* and *lower* as sometimes used in comparative anatomy.

2. That the cornua of the spinal cord, and the spinal nerve-roots, be designated as *dorsal* and *ventral* rather than as *posterior* and *anterior*.

3. That the costiferous vertebræ be called *thoracic* rather than *dorsal*.

4. That the *hippocampus minor* be called *calcar;* the *hippocampus major, hippocampus;* the *pons Varolii, pons;* the *insula Reilii, insula; pia mater* and *dura mater,* respectively *pia* and *dura.*"

Signed by all the members.

JOSEPH LEIDY, *Chairman.*
HARRISON ALLEN,
FRANK BAKER,
THOMAS B. STOWELL,
BURT G. WILDER.

Thomas Dwight was added to the committee.

The Committee desire frank and full expressions of opinion from scientific and medical journals, from individuals who receive copies, and from any others who are interested in the subject.

BURT G. WILDER, *Sec'y.*

SCIENTIFIC NEWS.

The Alvarenga Prize, of the College of Physicians of Philadelphia, consisting of one year's income of the bequest of the Señor Alvarenga, of Lisbon, has been awarded to Dr. R. W. Philip, of the Victoria Dispensary for Consumption and Diseases of the Chest, Edinburgh, for his Essay on Pulmonary Tuberculosis, which will be published by the College.

Entomological Club, A. A. A. S.—The Entomological Club of the A. A. A. S. will meet at Indianapolis, August 20, at 9 A. M. There should be a large attendance of entomologists at this meeting, especially of those in the West. The officers are: Professor A. J. Cook, President, and F. M. Webster, Secretary, and both are doing all in their power to make the meeting a success. Professor Cook writes: "Please urge a large attendance from both Canada and the United States. All are invited to be present, and to bring or send papers."

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PLATE XXIV.

Fig. 1

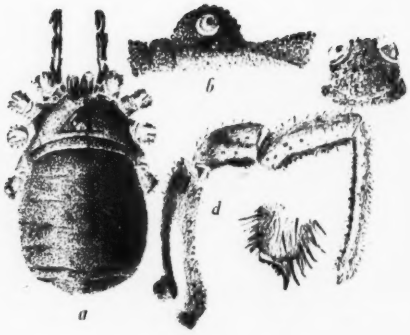

Fig. 2.

Astrobunus nigrum (Say).